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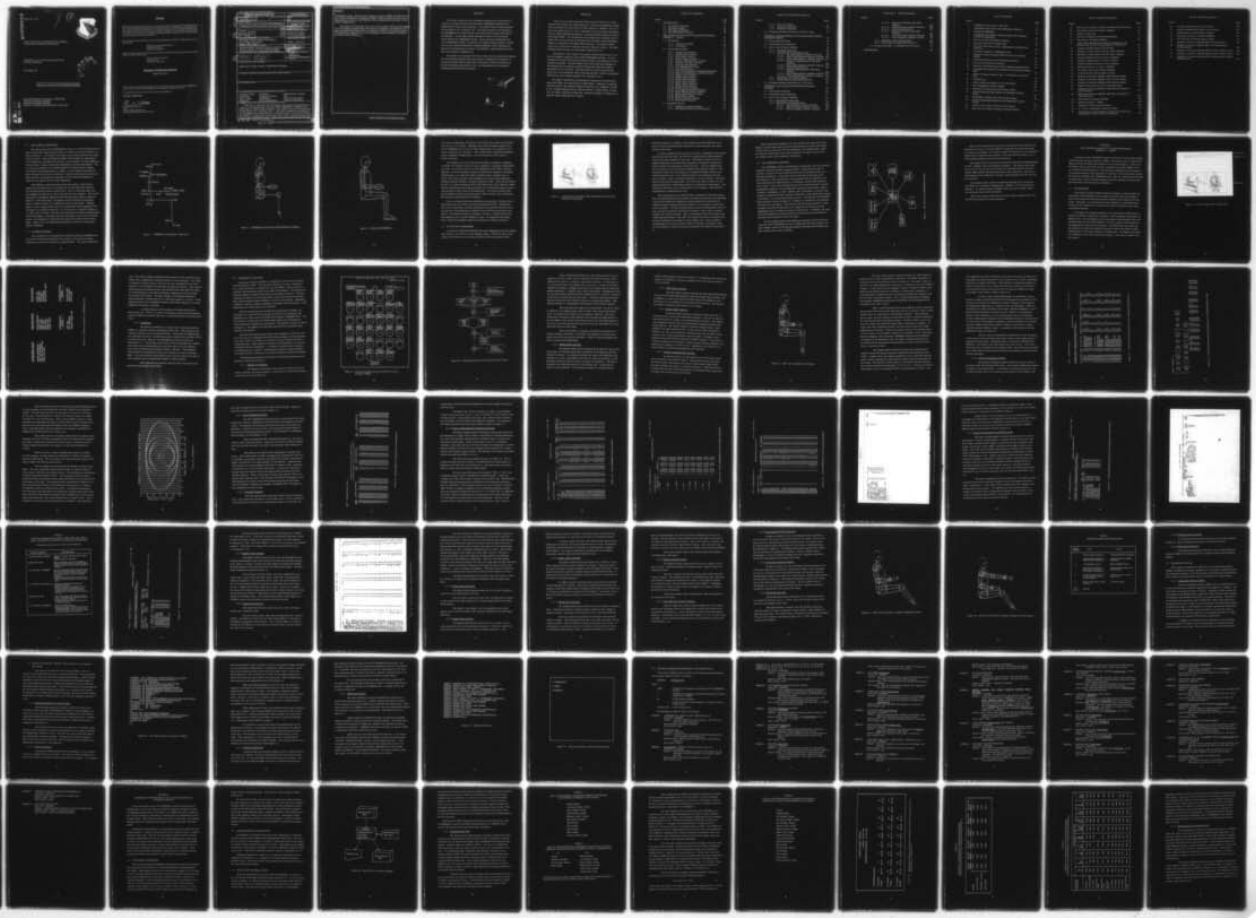

AMRL-TR-76-117

USER'S GUIDE FOR THE PROGRAMS OF COMBIMAN
(COMputerized BIomechanical MAN-Model)

UNIVERSITY OF DAYTON RESEARCH INSTITUTE
DAYTON, OHIO 45469

NOVEMBER 1976

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AEROSPACE MEDICAL DIVISION
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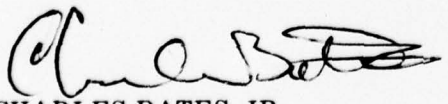

CHARLES BATES, JR.
Chief
Human Engineering Division
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This User's Guide has been developed to describe the operational procedures to be followed when using the AMRL COMBIMAN (COMputerized BIomechanical MAN-model) programs. The Guide is based on the programs as they stand as of 1 November 1976. The Guide includes an introduction to the COMBIMAN man-model and the conventions used to develop and analyze workstations. It also deals with the operation of three of the programs which make up the COMBIMAN system. These programs include the heart of the

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COMBIMAN system, the interactive graphics program CBM04, and the two key file creation/modification programs CBMAM, which maintains the data base of anthropometric surveys, and CBMWM, which maintains the data base of work-station configurations.

The guide to the operation of the three main routines includes descriptions of the processing available with each program, definitions and examples of all input and output data formats used, procedures to follow to load the programs and specify processing for each, and explanations of all diagnostic messages generated by the programs.

SUMMARY

This User's Guide has been developed to describe the operational procedures to be followed when using the AMRL COMBIMAN (COMputerized BIomechanical MAN-model) programs. The Guide is based on the programs as they stand as of 1 November 1976. The Guide includes an introduction to the COMBIMAN man-model and the conventions used to develop and analyze workstations. It also deals with the operation of three of the programs which make up the COMBIMAN system. These programs include the heart of the COMBIMAN system, the interactive graphics program CBM04, and the two key file creation/modification programs CBMAM, which maintains the data base of anthropometric surveys, and CBMWM, which maintains the data base of workstation configurations.

The guide to the operation of the three main routines includes descriptions of the processing available with each program, definitions and examples of all input and output data formats used, procedures to follow to load the programs and specify processing for each, and explanations of all diagnostic messages generated by the programs.

PREFACE

This work was performed under USAF Contract F33615-75-C-5092, entitled Biomechanics and Anthropometry for Cockpit and Equipment Design. The government work unit number for this contract is 71840824. The contract was monitored by Dr. Joe W. McDaniel of the Crew Station Integration Branch, Human Engineering Division, Aerospace Medical Research Laboratory (AMRL/HED). The development of the programs to which this User's Guide refers was performed by the University of Dayton Research Institute (UDRI), in conjunction with AMRL/HED personnel. The primary UDRI researcher on this User's Guide has been Ms. Susan M. Evans. The UDRI Technical Report number for this Guide is UDRI-TR-76-71.

The purpose of this report is to provide a detailed guide to the use of the key computer programs of the AMRL COMBIMAN program. It is not intended to document the theoretical approach taken in developing any of the computer programs. The description of the man-model and workspace in the introduction is presented as general background material needed to efficiently use the programs. The data which were used to generate the model were not described in detail as the experimental results of using these data have not been validated against real world data as yet.

The author would like to acknowledge the assistance provided by the staff of the UDRI, and by personnel of AMRL/HED. Particular recognition should be given to the technical support provided by Dr. McDaniel, as well as Dr. Kenneth Kennedy and Mr. Charles Clauser of AMRL/HED. In addition, the author would like to thank Ms. Charlene Thompson of UDRI for her patience while typing this User's Guide.

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INTRODUCTION

During the design and analysis phases of work station development, it is essential to assess the inadequacies and dangers of the work-station environment with respect to the human operator. The conventional method for accomplishing this has been to build mock-ups and then use an undetermined number of "representative" test pilots to evaluate the work environment and control placement. The mock-ups tend to be costly and time consuming to build, as well as somewhat inflexible during testing. The sample size of "representative" pilots is rarely constant, but rather depends on pilot availability and the whims of the designers.

The COMputerized BIomechanical MAN-model (called COMBIMAN) system of programs has been developed in an effort to assist in the design and analysis phases of work-station development. It has been designed to serve as an interactive-computer-graphics-assisted engineering tool to represent geometric and physical properties of man at this workplace. It has applications in the evaluation of existing workplaces, design of new workplaces, selection of criteria for personnel to fit workplaces, and mapping visibility plots. The COMBIMAN model is a three-dimensional man-model which may be viewed from any angle. Because the man-model and workplace exist only on the Cathode Ray Tube (CRT) and in computer memory, no significant amount of time or materials need be invested in making modifications. Alternative designs may be thoroughly evaluated and then permanently recorded by means of a pictoral plot or tabular printout of the workplace data and man-model (Reference 1). Because of these capabilities, the COMBIMAN should reduce or eliminate the need for building mock-ups, as the designer can construct a work station in three dimensions on a CRT and can assess interactions by using man-models of various body sizes and proportions.

1.1 MAN-MODEL GENERATION

The man-model used in COMBIMAN is based on a 33 link-skeletal system. Each of these links connects major points of rotation of the body segments, as shown in Figure 1. The lengths of the links of the skeletal system can be modified by the user. Since the segment lengths or link-lengths are generally internal dimensions and difficult to measure on live subjects, the link lengths are derived from 11 readily measurable anthropometric surface dimensions. The user also has available sets of anthropometric variables which are highly correlated to body segment mass or length. A more detailed description of these variables will be given in Section 3. Section 2 will describe the ways by which the user can change the proportions of the model by specifying new values for any number of the surface dimensions.

The definition of the link system of the man-model is only the first stage in the generation of the man-model but it is the stage with which the user has the greatest amount of interaction. The two remaining stages use data supplied in stage one as well as data stored in the computer. The second stage places enfleshment ellipsoids about the link system joints as shown in Figure 2. In the third stage, the ellipses are then connected with tangent lines, as shown in Figure 3, to define the contour of the model. Although Figures 1 thru 3 show only the side view of the model, three orthogonal viewing planes are available to the user: x-z (a side view, as shown in Figure 1), x-y (top), and y-z (front). The user may look at any two planes simultaneously on the CRT display. The model need not be parallel to any one of the viewing planes, and frequently is rotated by some angle with respect to the viewing plane. Steps 2 and 3 are performed separately for each view of the model which is displayed.

1.2 WORKSPACE DESIGN

The workspaces to be designed and evaluated using the COMBIMAN system consist of panels having three-to-six vertices, and control locations (which may or may not be located on a defined panel). The more complicated

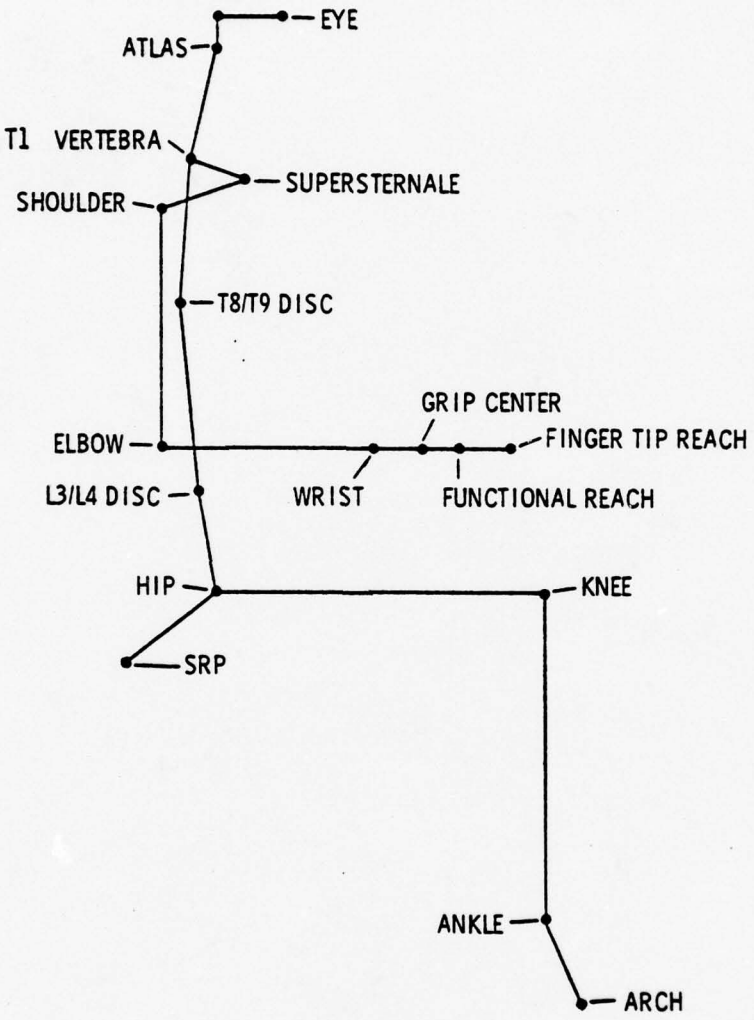

Figure 1. COMBIMAN Link System - Side View.

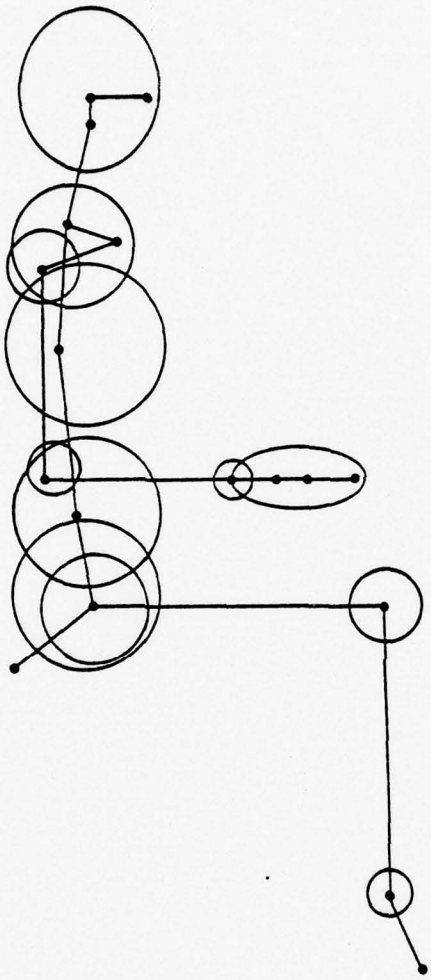

Figure 2. COMBIMAN Link System With Enfleshment Ellipses.

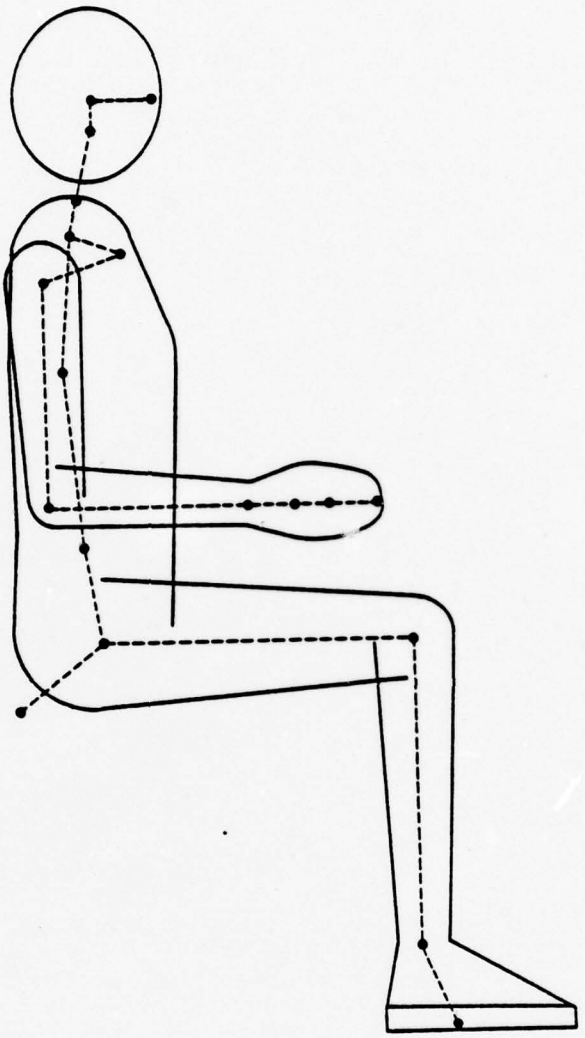

Figure 3. Enfleshed COMBIMAN.

work space configurations developed to date consist of as many as 210 panels and well over 150 controls. Although many of the workspaces which are in use in COMBIMAN are aircraft cockpit configurations, it is possible to construct and display any workspace. This would include automobile instrument panels, industrial configurations, and control panels for other types of military vehicles.

Two methods are used to generate and display workspaces, depending on whether the designer chooses to use an existing or conceptual configuration, or decides to construct a new one on the Cathode Ray Tube (CRT) using the light pen. In the first method, panels and controls for existing or conceptual configurations, are coded onto either computer cards, magnetic tape, or direct access disk, and then made available to the user and the interactive graphics program through a workspace database on disk. In the second method, the user can design workspaces at the CRT with the use of the light pen, alphanumeric keyboard and the program function keys, following the basic series of steps similar to those used on a drawing board. The series of steps in the second method is used to construct panels, define controls, and to determine the location of points within the workspace.

Once a workspace has been entered into the program, it exists in three dimensions and can be made to interact with the man-model. Because the CRT is two dimensional, the three dimensions are projected onto the screen by using two, two-dimensional orthogonal views of the man-model and work station. The display can then be enlarged, reduced, or rotated with the defined display area to suit the designers' needs. An example of the display with a rotated and magnified model and workspace are shown in Figure 4.

1.3 EVALUATION TECHNIQUES

A number of evaluation techniques have been implemented into the COMBIMAN system, and others are in the planning stages. Primarily, they are designed to allow the user to vary the proportions of the man-model to suit a

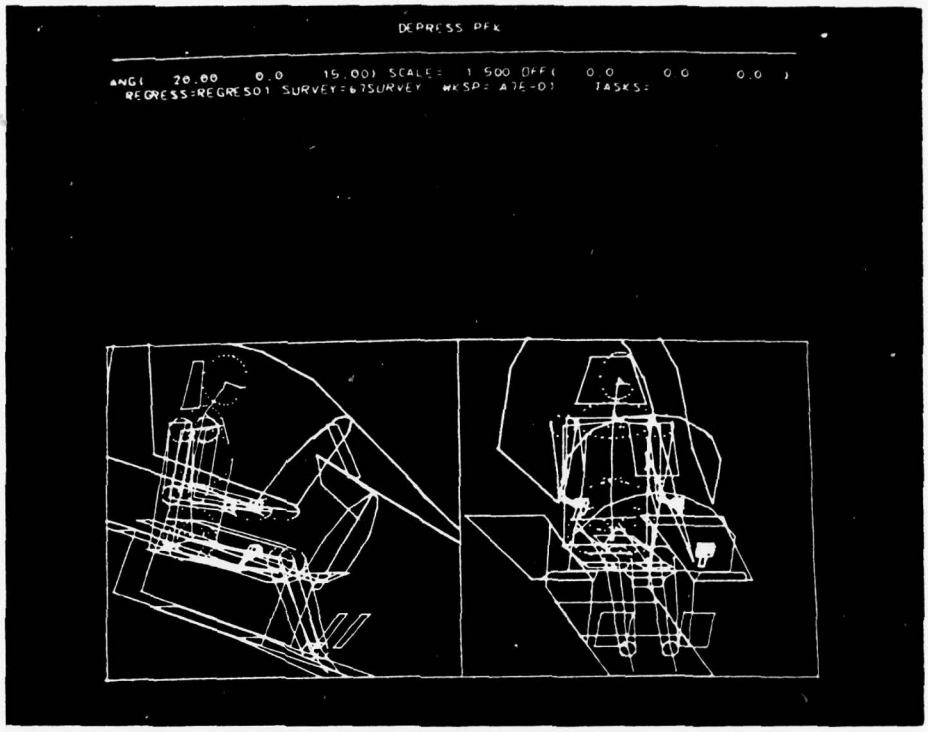

Figure 4. COMBIMAN CRT Display With Man-Model and Workspace Rotated and Magnified.

particular situation or problem, and to position the model within the workspace to aid in assessing human performance in task sequences and control and panel placement.

In order to display the man-model on the CRT, COMBIMAN uses information from on-line disk files, and from user supplied data on anthropometric surface dimensions obtained at run time. The ability to make use of user supplied dimension data permits the construction of models of variable proportions suited to the particular needs of the user. The user supplied data may be based on (a) direct measures obtained from specific subjects; or (b) percentiles which rely on the data base of summary statistic values for the absolute dimension; or (c) on a limited number of key dimensions the user has to consider, either as absolute dimensions, or as percentiles. The third option is generally the most useful, as it limits the range of values for user supplied dimensions, eliminating unrealistic combinations of dimensions. The option also allows the user to concentrate on the evaluation, rather than the manipulations of anthropometric data.

The man model can be positioned with a workplace by directly entering sets of rotational angles used to position the links of the model or by specifying a point on the display and letting the program optimize the values for the rotational angles and thus position the model so it is reaching as close to the point as possible. The later method applies to reach involving either arms or legs, and can incorporate restrictions to mobility, such as those caused by clothing and restraint systems. After recalculating values for the angles and regenerating the display on the CRT, the method also prints a message to the operator indicating a successful or unsuccessful reach. This is useful in establishing sets of reach envelopes within a particular workstation, using several samples of a given population to proportion the model (see Reference 2).

Other information available to the user includes hard copy plots of the display, printed output showing the three dimensional real world coordinates of the model and of the panels of the workstation, and visibility plots, which give the user information on the visual field of the workspace based on the eye position of the model existing on the display.

1.4 THE COMBIMAN PROGRAMS

The COMBIMAN system is divided into five programs, the main program being the interactive graphics program CBM04, which allows the user to generate a variable size man-model and then assess interaction with new or existing workstations. Before the user can define the proportions of the man-model, or call up workstation, and task sequences for evaluation, the files which store the anthropometric, workstation, and task data must have been created. This is done through the use of three specialized file creation/modification programs, each dealing with a particular type of data: anthropometric, workstation, or task. Similar sets of commands are used by each program to initialize the file, add data, delete data, write existing data groups to the printer, or to punch data groups to cards. The data flow of the COMBIMAN program is shown in Figure 5. In Figure 5, a fourth file, the initialization data set is also shown. This data set, and the program which it creates will not be described in this guide, as it should not be necessary for the COMBIMAN user to modify the contents of the data set. In addition, the Task Data Base Maintenance program will not be discussed as it is not fully implemented and available for use at this time.

The succeeding chapters will explain the operation of three of the key programs of the COMBIMAN system, including the interactive graphics program CBM04, and two of the file manipulation programs which maintain the files of data used as input to CBM04.

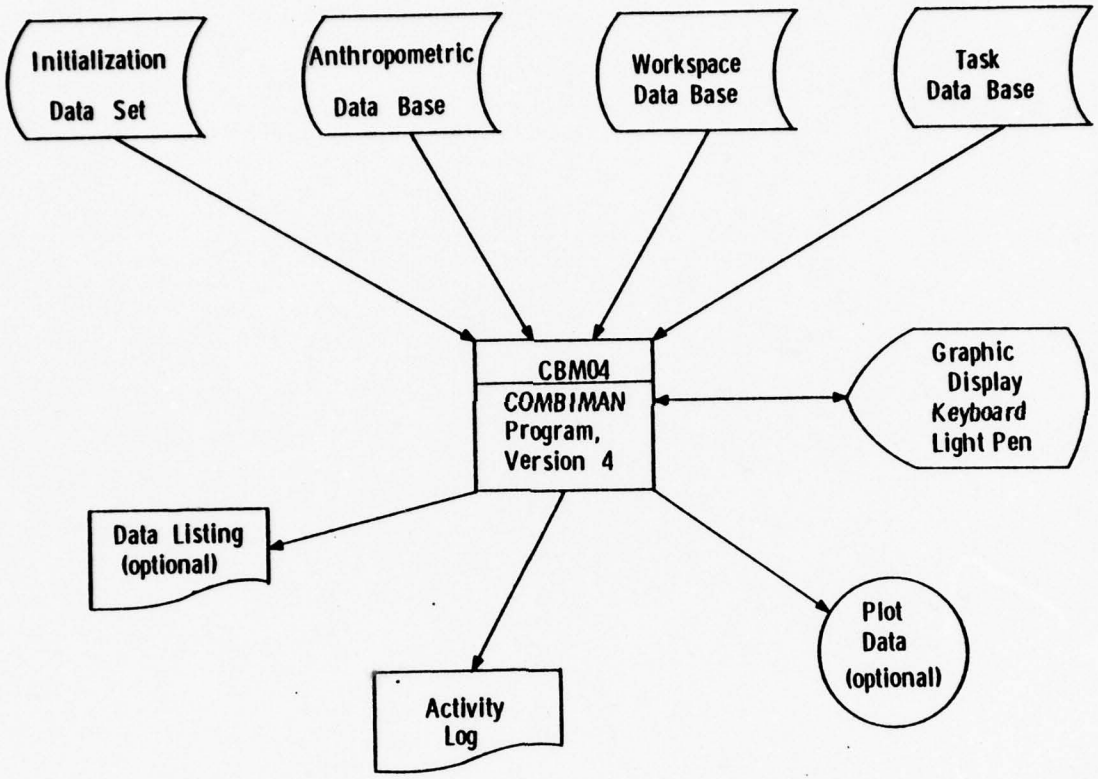

Figure 5. Data Flow in the COMBIMAN Program.

Section 2 will describe the use of each of the function keys which may be activated by the user in program CBM04 to manipulate the model and design and evaluate workstations. It will give examples of optional as well as standard output formats supplied by the program, and it will list the possible error or informational messages generated by the program.

The program which creates and maintains the data base of Anthropometric surveys, CBMAM, will be documented in Section 3. The types of data which may be stored, the sources for such data, the input data formats required, sample output formats and message formats will be discussed. The uses of and formats for the commands or functions which manipulate the file will also be described.

The program which creates and maintains the data base of geometric descriptions of workstation configurations, CBMWM, will be documented in Section 4. As with the program CBMAM, data sources, and input, output, and message formats will be described.

Each of the sections which follow will also contain examples of the Job Control cards needed to run the programs.

SECTION 2

THE COMBIMAN INTERACTIVE GRAPHICS PROGRAM VERSION 4, - CBM04

At the heart of the COMBIMAN system is the fourth version of the COMBIMAN interactive graphics program, CBM04. The program uses an IBM 2250-3 Display Unit for the design and analysis of man in his workspace. The user at the display device controls the course of execution of program CBM04 by use of a Program Function Keyboard. Depressing the lighted keys on the keyboard will request functions of the program to be executed. This section will describe the functions available to the COMBIMAN user, show the output that the functions may generate, and trace through suggested execution sequences for generating the man-model, and retrieving a workstation.

2.1 INTRODUCTION

The graphics program CBM04 enables the designer to bring together the information on anthropometry and workspaces stored on disk (see Sections 3 and 4) and combine this with the interactive qualities of the Cathode Ray Tube (CRT). Doing this, he can evaluate real-life conditions, or establish design criteria for new situations in a fraction of the time it would have taken using conventional methods.

For design and evaluation sequences, the 12-inch square CRT screen is partitioned similar to that shown in Figure 6, with prompting, information and display areas. The prompting area gives messages and commands to the user, indicating what his next action should be. It also is used to accept replys via the alphanumeric keyboard if so requested. The information area keeps the user posted as to what processing the program is doing, and indicates which anthropometric survey and workspace are being used. The display area shows two orthogonal views of the model and workspace. Each view is within a six-inch square.

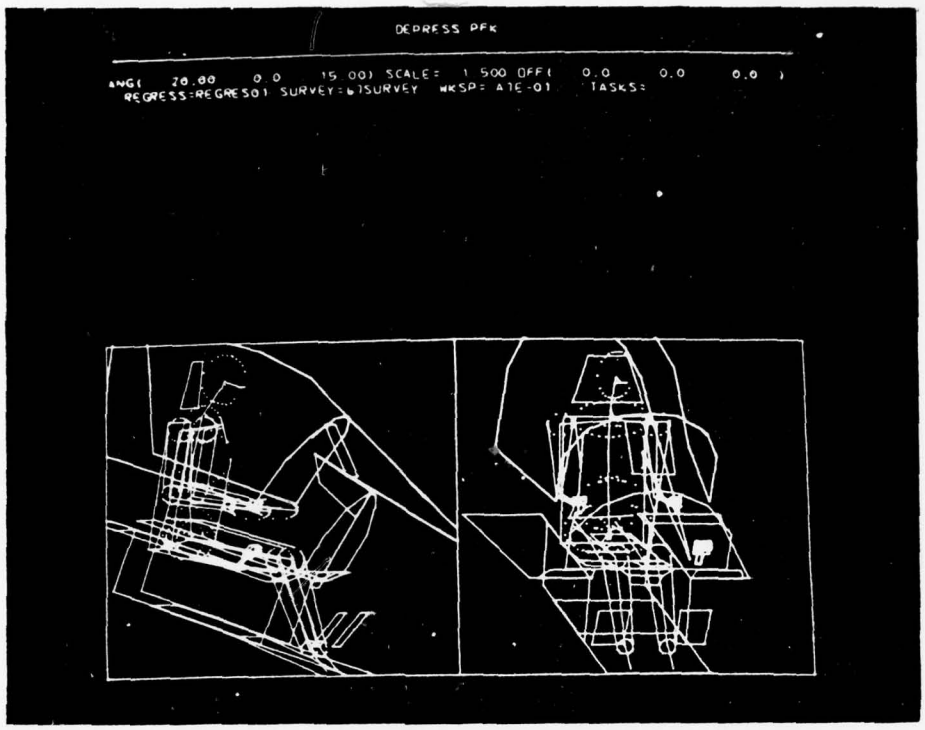

Figure 6. Format of IBM 2250-3 Display Unit.

Replies to prompting messages are given through the Alphanumeric Keyboard (ANKB); a Light Pen; or the Program Function Keyboard. Replies given through the ANKB are displayed in the Prompting area below the prompting message at the location of the cursor, a small underbar character. All replys made via the ANKB are terminated, and subsequently processed by the program, by simultaneously depressing the ALT CODING key and the 5 key.[1] Replies given by the light pen are done by placing the end of the pen over the desired lighted area, using the pen lights to aim, and pressing the pen barrel in toward the screen.

Figure 7 shows the IBM 2250-3 CRT in use. The user's left hand is on the Program Function Keyboard, and her right hand is using the light pen to identify a point on the screen. The Alphanumeric Keyboard is below the CRT.

2.1.1 Functions Available

The functions which are available to the user fall into five basic categories, as shown in Figure 8. The first category, the Anthropometry Related Functions, enables the user to retrieve data for a particular anthropometric survey from the Anthropometric Data Base, specify values for the surface dimensions of the man-model, and manipulate the geometry of the model to achieve the desired man-model configuration. The Workspace-Related functions let the user retrieve existing three-dimensional workspace configurations from the Workspace Data Base and then add to and modify the retrieved configuration. These functions also let the user start from the beginning of a design sequence, and create a new workstation configuration. The Display-Related functions allow the user to rotate and magnify the contents of the display area. They also enable the user to modify the contents by omitting, or including objects, or simply identifying objects within the

[1] In subsequent use in the text the simultaneous depression of the "ALT-CODING" and "5" Keys will be referred to as the ALT-CODE/5 sequence. IBM refers to this sequence as EOB (End of Block).

Figure 7. CRT Unit With Function Keys, Alphanumeric Keyboard and Light Pen.

ANTHROPOMETRY-RELATED

Retrieve Anthropometry
Enter Link Dimensions
Enter Two Key Dimensions
Display Link Table

WORKSPACE-RELATED

Retrieve Workspace
Design Panel
Define Control
Delete Panel
Delete Control
Change Panel
Change Control

DISPLAY-RELATED

Change View
Identify Object
Omit Object
Include Object
Note Light-Pen Location

PRINTER/PLOTTER-RELATED

Print Data
Plot COMBIMAN
Generate Visibility Plots

PROGRAM-EXECUTION-RELATED

Set Sense Switch
Restart Program
End Program

Figure 8. Functions Available to COMBIMAN User.

area. The Printer/Plotter Related functions supply the user with hard-copy output of the configuration of either the model or the workstation. The output is obtainable on either printer, after the user has completed his use of the program, or on the plotter seconds after selecting the function. This category of functions also provides the user with visibility plots which show the limits of visual fields given a specified workstation configuration and the present eye location of the model. The final category, the Program-Execution-Related functions, permits the user to restart the program, or end it. It also enables the user to set conditional switches which either suppress or activate additional processing or printing.

A standard feature of the program is a listing of all actions taken by the user. This is a sequence of messages printed after the graphics program CBM04 was ended by the user, or by the system due to unrecoverable error.

2.1.2 Limitations.

The primary limitations to consider when running the program CBM04 are computer memory and graphics buffer area. The program needs a memory partition size of 286 thousand bytes. When using the HESS facility, it is generally necessary to redefine the memory partitions on the IBM 370/155 to achieve this size. Steps for accomplishing this will be described in Paragraph 2.3.1. The graphic orders which create and maintain the complex man-model and workstation display on the CRT require a large amount of space in the 32-thousand-byte graphics-buffer-controller. The minimum amount needed to assemble the model and workstation is about 20 thousand bytes. To assure that this requirement is met, the user must be sure that no other graphics jobs are running when CBM04 is being executed.

Other limitations for specific functions will be described in the appropriate paragraphs which follow.

2.2 PROCESSING AVAILABLE

Functions of Program CBM04 are requested by means of the Program Function Keyboard (PFK). This keyboard consists of 32 keys, numbered 0 to 31, whose functions are assigned by program CBM04. When a function is activated, the appropriate button on the PFK will be lighted. The functions for Program CBM04 are shown on the PFK Overlay Mask in Figure 9. The activated keys in Figure 9 are described below, and can be referenced with the help of the paragraph number within the circle for each function. Requesting a function is done by a single, momentary depression of the desired key. Only lighted keys are enabled and can be activated.

Once the program has been loaded (for instructions on loading, see Paragraph 2.3.1) and all arrays and the screen have been initialized, the prompting area of the screen will display the message "DEPRESS PFK." The first sequence of steps the user follows should utilize the anthropometry-related functions to generate the man model. The approved sequence is shown in Figure 10. The numbers in each block reference the paragraphs which describe each function.

After the model has been generated, and is displayed on the CRT, the user may choose to manipulate the model using the display-related functions, or he may retrieve a workspace or develop a new one using the workspace related functions. When using the workspace related functions, the retrieve workspace function (Paragraph 2.2.6) should be specified before changing or deleting panels or controls. The program-execution-related functions (see Figure 8) may be depressed at any time during the execution of CBM04.

The following paragraphs describe the processing performed by each function as numbered in Figure 9.

2.2.1 Change View Function

The Change View function, when selected, allows the user to rotate, translate, and scale (magnify or reduce) the two views in the display area of the screen (see Figure 6).

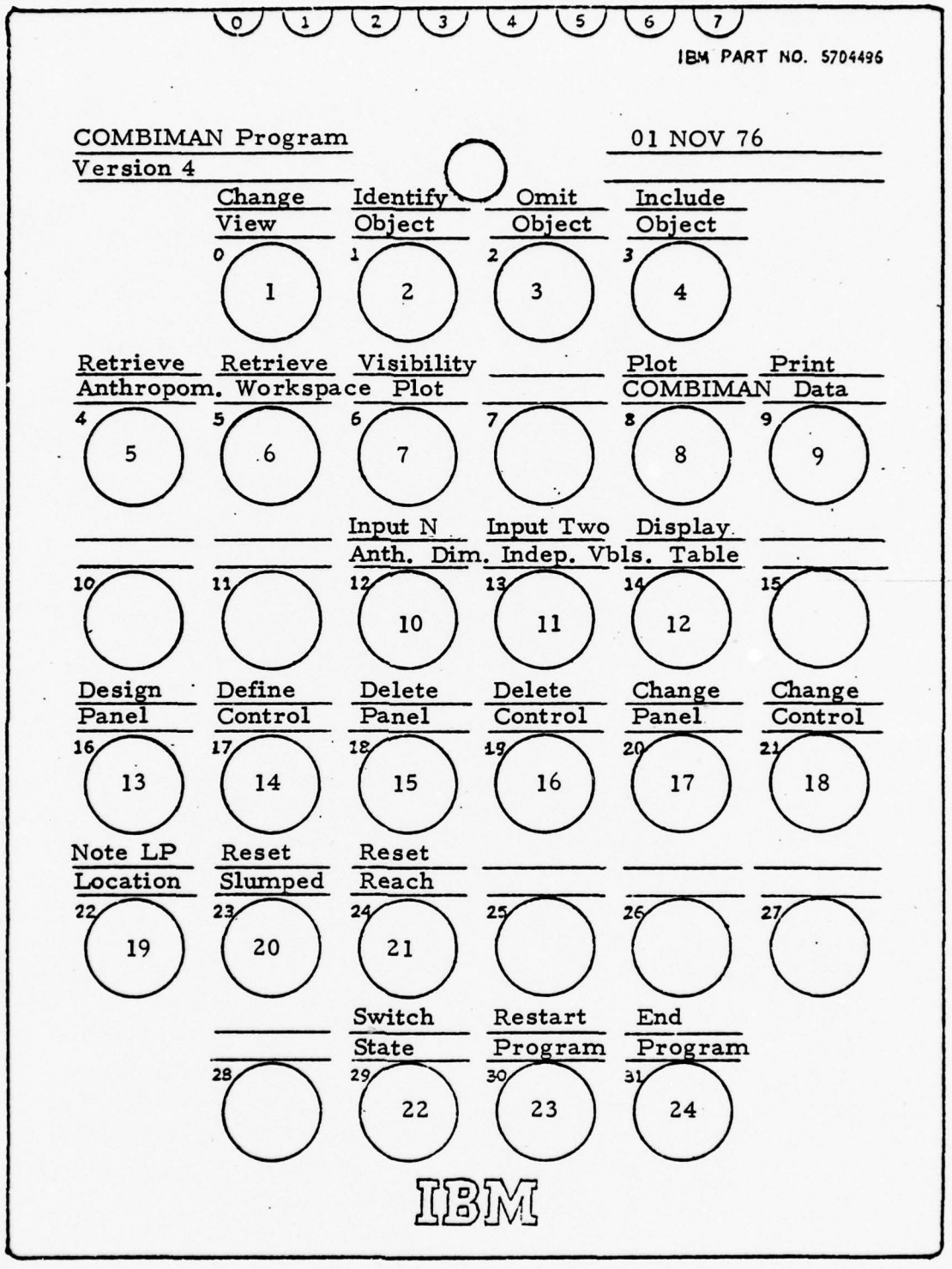

Figure 9. Program Function Keyboard (PFK) Overlay for Program CBM04.

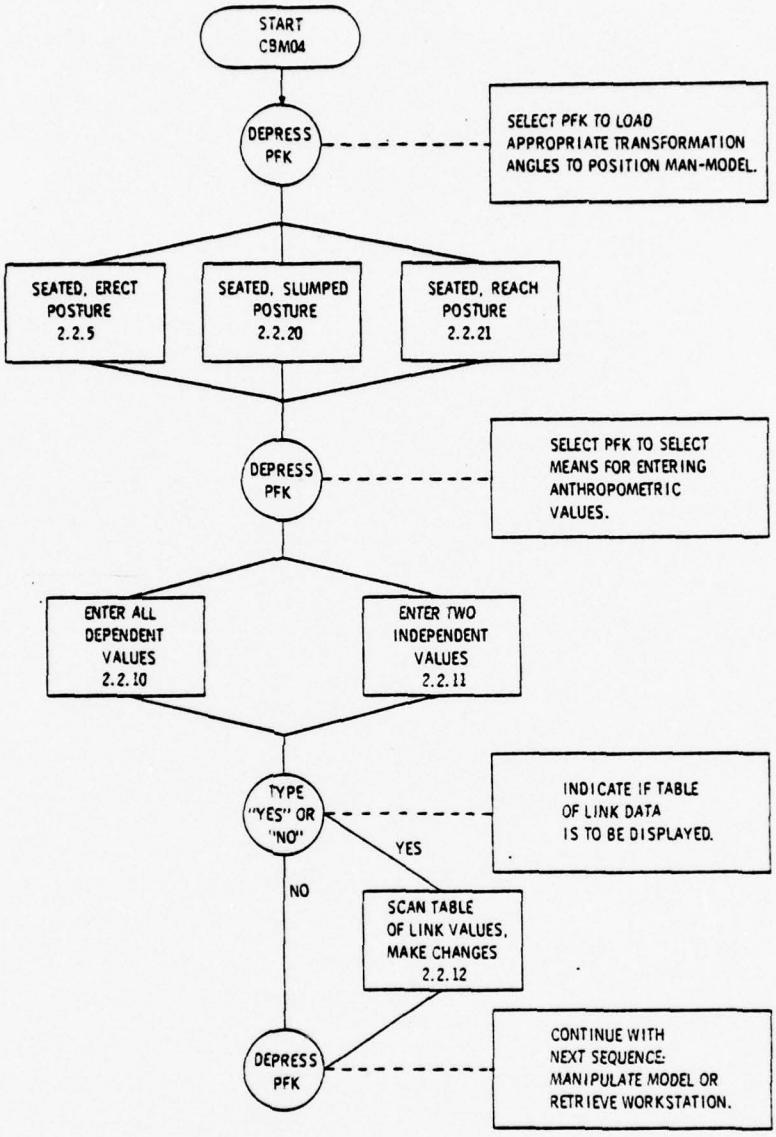

Figure 10. Function Sequence for Generating the Man-Model.

After selecting this function key, the program asks the user to supply the new roll, pitch, and yaw angles and the new scale factor via the alphanumeric keyboard. Angles are specified in degrees. A scale factor of 1.0, the normal value, best utilizes the screen area. A larger scale factor magnifies the display, chopping off any lines of the display that go outside the display boundaries. A smaller value reduces the display. Specifying no value for any of the angles indicates that the existing value is to be used. A positive value must be specified for the scale factor. Once the value has been typed the user presses the ALT-CODE/5 sequence to transmit the number. Specifying no change is accomplished by pressing the ALT-CODE/5 sequence.

After specifying the angles and a scale factor, the user is asked to light pen a new display center-point on either of the views in the display area, or to signal ALT-CODE/5 if no translation is desired. The three-dimensional coordinates of the endpoint of the link that was light-penned, or the coordinates of the vertex of the panel closest to the point light-penned is used as a new center point for the display area and all coordinates are translated with respect to this origin.

Once ALT-CODE/5 is signaled, the function performs the requested rotation, translation, and scaling, and displays the revised orthogonal views of the man and the workspace. Figure 6 shows the display area after a rotation and magnification.

2.2.2 Identify Object Function

The Identify Object function displays the 8-character name of the object (link or workspace panel) that is pointed to by the light pen when this function is selected. Also displayed besides the name is the distal-end point location in x, y and z coordinates of the link, if a link was pointed to, or the end point of the first edge of a panel, if a panel was pointed to. The data is displayed in the Informational Area of the Display Unit. An internal key number is also displayed. The internal key number is an unique integer

number which identifies each link and panel. It is displayed when objects are omitted and identified, and must be supplied by the user when an object is is to be included.

2.2.3 Omit Object Function

The Omit Object function generates the same data in the information area for the object light-penned as does the Identify Object function, but in addition, it removes the object from both views of the display screen. The object can be redisplayed via the Include Object function. The internal key number is displayed when the object is omitted.

2.2.4 Include Object Function

The Include Object function redisplays an object that was removed from the screen by the Omit Object functions. The user is asked to enter the internal key number via the alphanumeric keyboard. That number was displayed on the left side of the informational message from the Omit Object function. The number should be entered in integer format, right justified in an eight character field. In other words, if the internal key number is 25, the user would have to press the space bar six times to position the cursor at the second position from the right. The digits 2 and 5 should be keyed and followed by the ALT-CODE/5 sequence. Only valid internal key numbers are acceptable, and the program will keep asking for one until the user supplies one which is valid. Specifying a key number for an object which is currently being displayed will be ignored.

2.2.5 Retrieve Anthropometry Function

As shown in Figure 10, this function is one of the three which may be activated to generate the model. When used to bring in the model for the first time, this function will use the transformation angles which generate a sitting erect posture, as shown in Figure 11. When this function is called after the model has been displayed, the transformation angles used to position the previous model will be used.

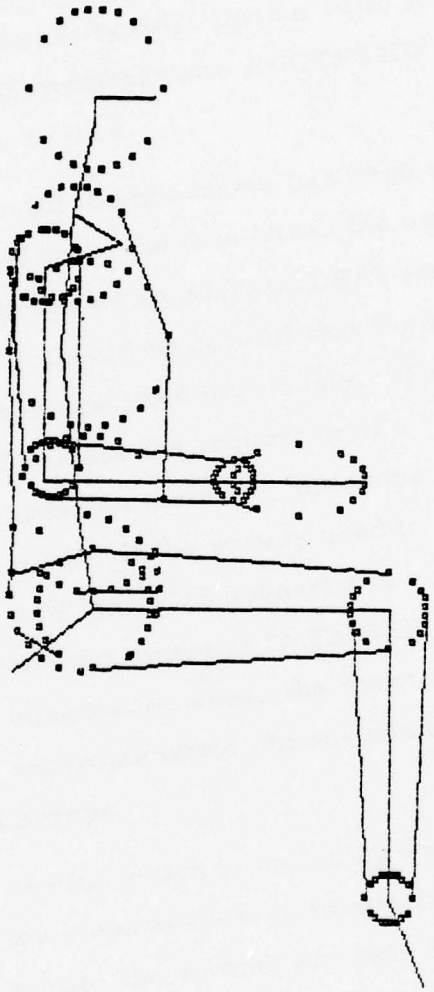

Figure 11. Side View of Seated Erect Posture.

The user is first asked to specify the name of a valid regression member (type 0) of the Anthropometric Data Base. (A detailed explanation of regression and survey members is given in Section 3.) The name, which can be from one to eight alphanumeric characters, is followed by the ALT-CODE/5 sequence. If the model has been displayed, and the regression member name which was specified previously is suitable, no name need be specified. If an invalid name is supplied and one is needed, the routine will continue to ask for one until a valid name is typed. Once a valid membername is supplied, the message "MEMBER membername ACCEPTED" will be displayed in the information area of the screen.

After a valid membername has been supplied, and the regression data has been retrieved from the data base, the user is asked to enter a survey member (type 1), followed by an ALT-CODE/5 sequence. When entering a survey name, the user should be careful that the name is valid and references the regression member specified previously. If either of these cases is not met, the routine will restate the request until a valid name is supplied. As in the case of the regression member, the name may be from one to eight alphanumeric characters. If the survey used to generate the existing model is to be reused, an ALT-CODE/5 sequence is acceptable. Once a valid name has been supplied, and the message "MEMBER membername ACCEPTED" is displayed in the information area, the means, standard deviations and percentiles for the anthropometric dimensions are retrieved from the data base and stored in arrays.

The routine which is called by the Retrieve-Anthropometry function controls the steps necessary to specify the anthropometry for the model. In other words, the routine prompts the user to supply the anthropometric surface dimensions or internal link lengths vital to the generation of the model. The sequence of steps which are associated with these function keys will be described in Paragraphs 2.2.10 to 2.2.12. If the user activated State Switch 6 prior to selecting the Retrieve Anthropometry function, and

if he supplied new surface dimensions, the routine will print each link name, its length, the surface dimension it was calculated from, and the enfleshment ellipsoid axes lengths and offsets. (Instructions on setting State Switches is given in Paragraph 2.2.22.) These link data will be sent to a print-file on disk and will be output on the printer once the program CBM04 has ended. An example of this output is shown in Figure 12.

As soon as the internal link lengths are established, control passes to another subroutine where the three-dimensional coordinates of the end point of each link are established, and the coordinates of the points on the enfleshment ellipsoids are calculated in two viewing planes. While the coordinates are being calculated, the message "HUMAN ASSEMBLY" is displayed in the information area of the screen. If the user activated State Switch 72 (see Paragraph 2.2.22 for instructions) prior to selecting the Retrieve Anthropometry function, the transformation matrices (see Reference 5), link vectors, link endpoint coordinates, and the coordinates of the points along the elliptical projections would be written to a print file for output when the program CBM04 is ended. An example of this output for the link STOMACH is shown in Figure 13.

Once the link and enfleshment coordinates have been calculated, control passes to the subroutine which gives orders to the graphics buffer to generate the man-model. During this stage, the message "GENERATING DISPLAY" is presented in the information area of the screen. Once all the orders have been assembled in the graphics buffer, the CRT display will flash two or three times and the new man-model and workstation (if one previously existed) will appear.

2.2.6 Retrieve Workspace Function

The Retrieve Workspace function allows the user to retrieve a workspace from the Workspace Data Base. The program CBM04 then displays workspace on the Display Unit. A workspace is retrieved by typing the one to eight character name of a workspace which exists in the Workspace Data

COMBIMAN LINK DATA

REFERENCED SURVEY OF REGRESSION EQUATIONS IS REGRESOI
REFERENCED SURVEY OF ANTHROPOMETRIC DIMENSIONS IS 67SURVEY

NO.	LINK NAME	LENGTH	REF. ANTH. DIM.	A-LENGTH	A-OFFSET	B-LENGTH	B-OFFSET	C-LENGTH	C-OFFSET
1	SRP	0.0		0.0	0.0	0.0	0.0	0.0	0.0
2	SRP-MHIP	5.97	BUTTOCK-KNE LGTH	5.039	-1.000	8.235	0.0	5.039	0.0
3	STCMACH	5.54	ACROMION HGT/SIT	5.038	0.967	6.889	0.0	5.038	0.0
4	CHEST	10.05	SITTING HEIGHT	5.154	1.734	7.153	0.0	5.154	0.0
5	LWR NECK	7.95	SITTING HEIGHT	3.422	0.300	6.844	0.0	3.422	-1.800
6	UPR NECK	5.55	SITTING HEIGHT	0.0	0.0	0.0	0.0	0.0	0.0
7	MID HEAD	1.51	SITTING HEIGHT	4.113	0.0	3.220	0.0	4.734	0.340
8	MH-MEYE	3.53	SITTING HEIGHT	0.0	0.0	0.0	0.0	0.0	0.0
9	MEYE-REY	1.25		0.0	0.0	0.0	0.0	0.0	0.0
10	MEYE-LEY	1.25		0.0	0.0	0.0	0.0	0.0	0.0
11	LN-MIDSS	3.41	SITTING HEIGHT	0.0	0.0	0.0	0.0	0.0	0.0
12	MSS-RSS	1.00		0.0	0.0	0.0	0.0	0.0	0.0
13	RSS-RSLD	9.41	BIACROMIAL BRDTH	2.419	0.0	2.419	0.0	2.419	0.0
14	RSLD-RLB	12.99	SHOULDR-ELB LGTH	1.949	0.470	1.549	0.0	1.949	-0.713
15	RLB-RRST	10.80	FORARM-HAND LGTH	1.103	0.0	0.883	0.0	1.103	0.0
16	RRST-RGR	2.60	HAND LENGTH	2.213	0.0	0.624	0.0	4.105	1.502
17	RRST-RFR	4.94	HAND LENGTH	0.0	0.0	0.0	0.0	0.0	0.0
18	RRST-RFT	7.95	HAND LENGTH	0.0	0.0	0.0	0.0	0.0	0.0
19	MSS-LSS	1.00		0.0	0.0	0.0	0.0	0.0	0.0
20	LSS-LSLD	9.41	BIACROMIAL BRDTH	2.419	0.0	2.419	0.0	2.419	0.0
21	LSLD-LLB	12.99	SHOULDR-ELB LGTH	1.949	0.470	1.549	0.0	1.949	-0.713
22	LLB-LRST	10.80	FORARM-HAND LGTH	1.103	0.0	0.883	0.0	1.103	0.0
23	LRST-LGR	2.60	HAND LENGTH	2.213	0.0	0.624	0.0	4.105	1.502
24	LRST-LFR	4.94	HAND LENGTH	0.0	0.0	0.0	0.0	0.0	0.0
25	LRST-LFT	7.95	HAND LENGTH	0.0	0.0	0.0	0.0	0.0	0.0
26	MHIP-RHP	3.08	HIP BREADTH	3.549	0.0	3.549	0.0	3.549	0.0
27	RHP-RKNE	17.65	BUTTOCK-KNE LGTH	2.305	0.0	2.305	-0.114	2.305	-0.114
28	RKNE-RNK	16.90	KNEE HGT/SITTING	1.436	0.0	1.436	0.0	1.436	0.0
29	RNK-RRCH	5.39	FOOT LENGTH	0.0	0.0	0.0	0.0	0.0	0.0
30	MHIP-LHP	3.08	HIP BREADTH	3.549	0.0	3.549	0.0	3.549	0.0
31	LHP-LKNE	17.65	BUTTOCK-KNE LGTH	2.305	0.0	2.305	0.114	2.305	-0.114
32	LKNE-LNK	16.90	KNEE HGT/SITTING	1.436	0.0	1.436	0.0	1.436	0.0
33	LNK-LRCH	5.39	FOOT LENGTH	0.0	0.0	0.0	0.0	0.0	0.0

Figure 12. Link Data Calculated Based on User-Supplied Anthropometry.

STOMACH , HEIRARCHY= 3

$$\begin{bmatrix} 0.98 & 0.0 & -0.18 \\ 0.0 & 1.00 & 0.0 \\ 0.18 & 0.0 & 0.98 \end{bmatrix} = \begin{bmatrix} 0.59 & 0.0 & 0.81 \\ 0.0 & 1.00 & 0.0 \\ -0.81 & 0.0 & 0.59 \end{bmatrix} \times \begin{bmatrix} 0.44 & 0.0 & -0.90 \\ 0.0 & 1.00 & 0.0 \\ 0.90 & 0.0 & 0.44 \end{bmatrix}$$

$$\begin{bmatrix} 3.60 \\ 0.0 \\ 8.79 \end{bmatrix} = \begin{bmatrix} 0.98 & 0.0 & -0.18 \\ 0.0 & 1.00 & 0.0 \\ 0.18 & 0.0 & 0.98 \end{bmatrix} \times \begin{bmatrix} 0.0 \\ 0.0 \\ 5.50 \end{bmatrix} + \begin{bmatrix} 4.60 \\ 0.0 \\ 3.38 \end{bmatrix}$$

$$\begin{bmatrix} 4.58 & -3.22 & 13.42 \\ 4.58 & -1.15 & 13.93 \\ 4.55 & -1.15 & 4.00 \\ -0.41 & 0.0 & 8.04 \\ 8.06 & 0.0 & 5.35 \\ 6.01 & 0.0 & 4.14 \\ 3.76 & 0.0 & 3.99 \\ 1.27 & 0.0 & 5.13 \end{bmatrix} \begin{bmatrix} 4.52 & 3.22 & 4.51 \\ 4.51 & 1.15 & 4.00 \\ 4.55 & 1.15 & 13.93 \\ 0.12 & 0.0 & 11.36 \\ 2.03 & 0.0 & 13.33 \\ 4.19 & 0.0 & 13.99 \\ 6.54 & 0.0 & 13.59 \\ 9.50 & 0.0 & 9.89 \end{bmatrix} \begin{bmatrix} 4.55 & -1.15 & 13.93 \\ 4.52 & -3.22 & 4.51 \\ 4.51 & -1.15 & 4.00 \\ 8.98 & 0.0 & 6.56 \\ 7.06 & 0.0 & 4.60 \\ 4.91 & 0.0 & 3.94 \\ 2.56 & 0.0 & 4.33 \end{bmatrix} \begin{bmatrix} 4.55 & 1.15 & 4.00 \\ 4.58 & 3.22 & 13.42 \\ 4.58 & 1.15 & 13.93 \\ 1.03 & 0.0 & 12.57 \\ 3.09 & 0.0 & 13.78 \\ 5.33 & 0.0 & 13.94 \\ 7.82 & 0.0 & 12.79 \end{bmatrix}$$

Figure 13. Transformation Equation Development for Positioning Stomach Link.

Base, and following the name with an ALT-CODE/5 sequence. If no name is specified and ALT-CODE/5 is signaled, the function is ignored. If a workspace name is specified and one already is being displayed, the new workspace is displayed in addition to the existing one, providing the total number of panels for all workspaces involved does not exceed 250. If it does, the user is informed of this and asked to erase one or more workspaces. In order to erase an existing workspace from the display "(ERASE)" must be typed in followed by ALT-CODE/5. The program will then return, and ask for the desired workspace. After entering the name, the display will be regenerated, using the workspace specified most recently.

It should be noted that the time needed to create a display is dependent on the complexity of the workspace; that is, the number of panels and controls.

If State Switch 2 (see Paragraph 2.2.22) was activated prior to enabling this function, panel names and vertex coordinates will be sent to an output file to be printed as part of the Activity Log when the program CBM04 has ended. An example of this output is shown in Figure 14.

2.2.7 Visibility Plot Function

The Visibility Plot function calculates the limits of the fields of vision of the present configuration of the model and superimposes these limits over the canopy and windscreen boundary of an existing workspace and plots them both on an on-line Gould plotter. At the present time, the workspace which is being used is that for the A7 cockpit. As the necessary drawings for more workspaces become available to the system designers, more boundaries will be added to a special disk file and be made available to the user. But for the present, the A7 is the only outline available to the user. If, for some reason, the disk file does not contain any workspace boundary data, the message "NO DATA AVAILABLE FOR VISIBILITY PLOT ON UNIT 9" will be displayed in the information area of the screen. The routine is ended and the user is asked to depress another function key. The user should also inform the system programmer of the problem.

```
CBM0141 W/S DATA FROM A7E-01
CBM0071    1.) LMIPAN   , TYPE= 1, 6 VERTICES
CBM0071 29.75  0.0   5.94 29.75 14.75  5.94 31.34 14.75 13.39 32.59  9.57 19.30
CBM0071 33.20  4.50 22.14 33.20  0.0  23.00
CBM0071    2.) RMIPAN   , TYPE= 1, 6 VERTICES
CBM0071 29.75  0.0   5.94 29.75-14.75  5.94 31.34-14.75 13.39 32.59 -9.57 19.30
CBM0071 33.20 -4.50 22.14 33.20  0.0  23.00
CBM0071    3.) FWDLHCON, TYPE= 1, 5 VERTICES
CBM0071 26.23  9.25  2.89 26.23 18.75  2.89 28.31 18.01  4.68 29.79 17.18  5.93
CBM0071 29.79  9.28  5.93
CBM0071    4.) LHCON    , TYPE= 1, 4 VERTICES
CBM0071 26.09  9.25  2.76 -8.40  9.25  2.76 -8.40 23.01  2.76 26.09 20.00  2.75
CBM0071    5.) AFTLHCON, TYPE= 1, 4 VERTICES
CBM0071 -3.35  8.50  2.76 -8.53  8.50  2.76 -8.53 23.52  2.76 -3.40 23.00  2.75
CBM0071    6.) FWDRHCON, TYPE= 1, 5 VERTICES
CBM0071 26.23 -9.25  2.89 26.23-18.75  2.89 28.31-18.01  4.68 29.79-17.18  5.93
CBM0071 29.79 -9.28  5.93
CBM0071    7.) RHCON    , TYPE= 1, 4 VERTICES
CBM0071 26.09 -9.25  2.76 -8.40 -9.25  2.76 -8.40-23.53  2.76 26.09-20.00  2.75
```

Figure 14. Sample Workspace Member Data, As Printed in the Activity Log.

Once the function key has been depressed and the boundaries read in, the prompting area will display the message "ENTER EYE LOCATION (LINK)". The user must decide on the eye point to be used as a reference for the plots. Possible values are either 8 for Mid-Eye point, 9 for Right Eye point or 20 for Left Eye point. These values should be typed in, right justified in the eight digit field (that is, space either seven or six places and type the one or two digit value) and follow by the ALT-CODE/5 sequence. Once a valid link number has been specified, the message "PLOTTING" is displayed in the information area of the screen.

The routine uses the coordinates which define the endpoint of the mid-head link (link 7) and the coordinates of the eye location link to calculate the angles of sight from horizontal and from vertical. Facing forward and looking straight ahead would be an angle of 0° from both horizontal and vertical.

Figure 15 shows a sample visibility plot with the A7 outline. For this example, the man-model was positioned in a seated erect posture, looking straight ahead. The vision limits were generated with respect to the angle of sight of the Mid-Eye point (link 8).

The four ellipses on the plot define the limits of various visual fields. The inner most field, plotted with the letter S, defines the field of stereo vision, with both eyes looking forward. The field plotted with the letter F defines the fixation limits of vision. The field plotted with the letter P defines the limits of peripheral vision associated with the eyes facing forward with respect to the head. The outermost field, plotted with the letter M, defines the maximum peripheral vision limits for the extreme eye deviation. The symbol ⊙ is the eye location of the model. In addition to generating a hard copy plot on the Gould unit, the routine also calculates and writes to the printer the three dimensional coordinates of the visibility plot, in five degree angle increments from -180° from horizontal line of sight to +180°. The coordinates are given in the aircraft system of coordinates. The listing also

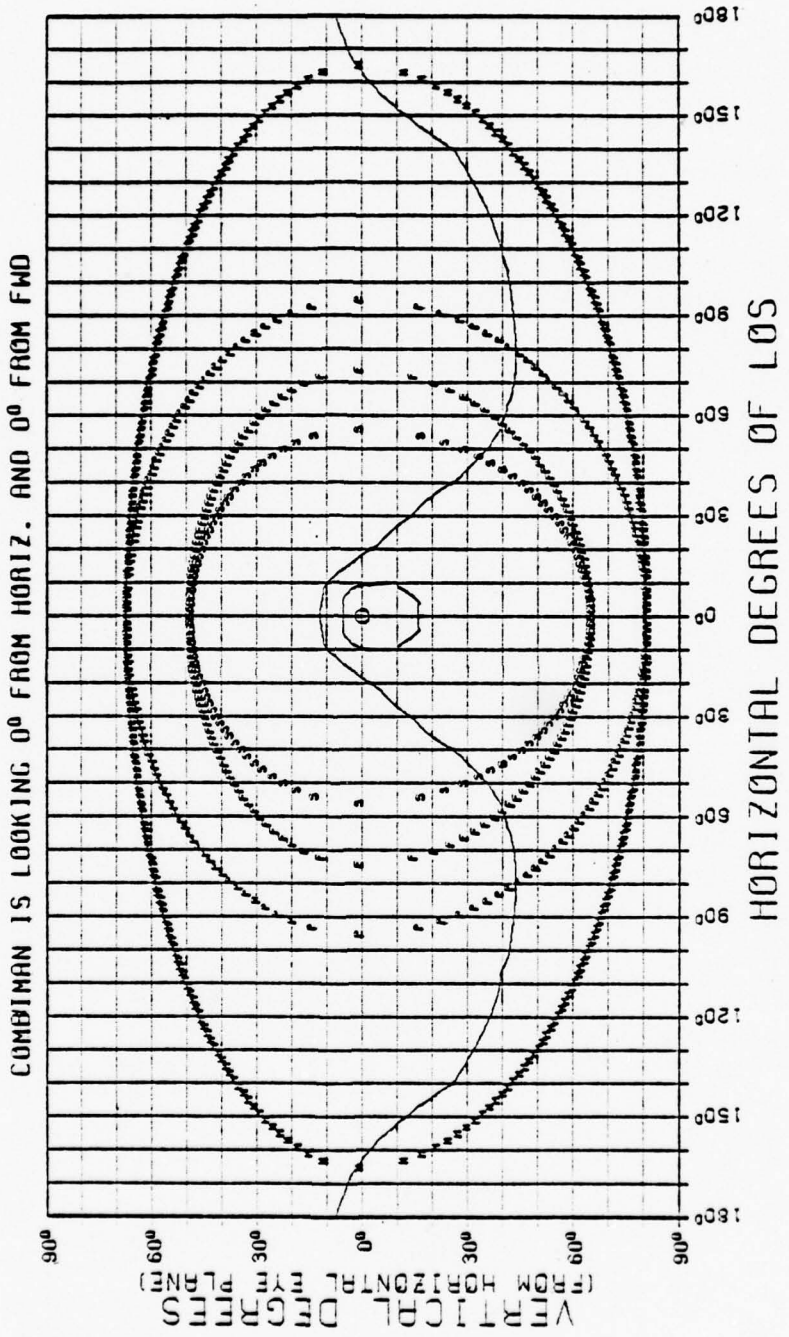

Figure 15. Visibility Plot.

gives the coordinates of the eye location in the aircraft system. Figure 16 shows the coordinate data for the plot in Figure 15.

2.2.8 Plot COMBIMAN Function

The Plot COMBIMAN function generates on-line plots of the man-model and workspace configuration currently shown in the display area of the screen. The function will always generate front and side views of the configuration. A third view, the top view, will be generated if State Switch 11 was set prior to generating the man-model. For instructions on setting the State Switches, see Paragraph 2.2.22.

After depressing the Plot COMBIMAN function key, the user is asked to enter a plot scale factor. Plots may not exceed 60 inches in height; (for front and side view plots, this will be the maximum range along the Z-axis).

This should be considered when specifying the decimal scale factor. Plots greater than 10 inches in height will be generated on from two to six sheets, each sheet containing a horizontal slice of data, ten inches in height, and will have to be taped together for the full plot. Response time will be improved if a plot height no more than 10 inches is used. Generally a scale factor of .15 or less will achieve this. To enter the scale factor, the user types the decimal value in the field and then depresses the ALT-CODE/5 sequence. When a valid scale factor has been entered, that is one greater than 0 and less than 1, the message "PLOTTING" will appear in the informational area of the screen and the plotter will generate the image. Once the plotting is finished, the message "DEPRESS PFK" will appear in the prompting area of the screen.

2.2.9 Print Data Function

The Print Data function prints man-model data and workspace data. Man-model data consists of, for each link, the x, y and z coordinates of the distal end of each link, the transformation angles for each link, the

CBM04 --- COMBIMAN PROGRAM, VERSION 4

VISIBILITY PLOT DATA FOR COCKPIT CANOPY CLEARLINE

EYE LOCATION IN AIRCRAFT SYSTEM (261.60, -6.00,130.15)

HORIZ. ANGLE	AIRCRAFT COORDINATES FS	BL	WL	HORIZ. ANGLE	AIRCRAFT COORDINATES FS	BL	WL	HORIZ. ANGLE	AIRCRAFT COORDINATES FS	BL	WL
-180	287.029	31.429	117.110	-60	246.732	9.584	134.641	60	264.766	-5.891	114.861
-175	282.691	31.135	116.400	-55	246.862	8.599	133.816	65	265.947	-5.965	114.925
-170	279.055	30.929	116.079	-50	247.046	7.273	132.282	70	267.199	-6.008	114.997
-165	275.839	30.663	115.780	-45	275.653	6.000	130.474	75	268.634	-6.183	115.131
-160	273.013	30.475	115.521	-40	247.661	4.780	129.112	80	270.234	-6.331	115.278
-155	270.499	30.451	115.303	-35	248.041	3.609	127.648	85	272.032	-6.433	115.436
-150	268.155	30.464	115.086	-30	248.482	2.435	126.217	90	274.143	-6.544	115.624
-145	265.820	29.933	114.911	-25	248.921	1.385	124.826	95	276.816	-6.768	115.866
-140	263.680	29.774	114.726	-20	249.475	0.346	122.679	100	280.153	-6.991	116.183
-135	261.600	29.588	114.510	-15	250.145	-0.614	120.957	105	284.623	-7.293	116.582
-130	259.555	29.366	114.329	-10	250.868	-1.515	119.356	110	289.095	-6.821	119.508
-125	257.515	29.167	114.267	-5	251.656	-2.344	117.943	115	290.397	-4.481	123.408
-120	255.432	29.019	114.353	0	252.389	-3.211	116.655	120	291.528	-2.019	126.726
-115	253.525	28.186	115.370	5	253.220	-3.987	115.566	125	292.366	0.575	129.463
-110	251.938	26.720	117.420	10	254.105	-4.819	114.945	130	293.100	3.244	131.662
-105	250.536	25.163	120.020	15	255.245	-5.007	114.415	135	293.635	6.000	133.339
-100	249.367	23.471	123.113	20	256.416	-5.117	114.208	140	293.959	8.831	134.350
-95	248.513	21.596	126.126	25	257.522	-5.204	114.165	145	294.433	11.789	135.423
-90	247.806	19.792	128.547	30	258.586	-5.247	114.255	150	294.015	14.686	134.523
-85	247.338	17.967	130.523	35	259.595	-5.371	114.337	155	293.672	17.674	133.455
-80	246.978	16.238	132.847	40	260.594	-5.493	114.419	160	293.116	20.696	131.710
-75	246.765	14.565	134.544	45	261.600	-5.606	114.522	165	292.286	23.717	129.219
-70	246.608	12.963	134.829	50	262.625	-5.720	114.630	170	291.244	26.757	125.882
-65	246.644	11.444	134.901	55	263.681	-5.805	114.743	175	289.808	29.669	121.631

Figure 16. Canopy Outline Coordinates in Aircraft System.

weight (mass) of the link and the enfleshment semi-axes lengths at the distal end of the link.

Workspace data, for the workspace currently being displayed, consist of the name, type, and x, y, and z coordinates for each vertex of each workspace panel. Also printed is the name, type, panel located on (if any), and coordinates of each control of the displayed workspace. An example of the output generated by the Print Data function is shown in Figure 17.

2.2.10 Input N Anthropometric Dimensions Function

The Input N Anthropometric Dimensions function gives the user the opportunity to supply values, either as percentiles or absolute dimensions, for each of the dependent anthropometric variables needed to construct the link system of the model. At the present time, there are 11 dependent variables. Generally, the user would use the Input Two Independent Variables function (PFK12), but if the user has obtained measurements from a human subject, this function would be useful. This function can be selected only after the user has depressed PFK4, 23 or 24.

The CRT screen is formatted as shown in Figure 18. The dependent variables and their default, or predefined unit of measurement are displayed on the left side of the display area. Alternative units of measurement are listed under the heading "AVBL UNITS."

The user must first type in the response "YES" or "NO" to the prompting message "WILL VALUES BE IN PERCENTILES". If the user response was YES, the user then responds to the prompt "L. P. PERCENTILE" by light penning the appropriate percentiles for each dependent variable as they are underlined. If the response was NO, the user is asked to "ENTER NEW VALUE" by typing a dimension for the underlined dependent variable. The next prompting message asks the user to "L. P. NEW UNIT, IF DESIRED." If the user wishes to change the unit of measurement of the input dimension, he would light pen the appropriate unit of measurement. Units for weight variables must be either pounds (LB) or kilograms (KG), other variables

COMBIMAN LINK DATA

SURVEY DATA IS 67SURVEY

NO.	NAME	DISTAL END X	DISTAL END Y	DISTAL END Z	JOINT ANGLES PHI	JOINT ANGLES THETA	JOINT ANGLES PSI	WEIGHT (KG)	RADIUS DS.X	RADIUS DS.Y	RADIUS PR.X	RADIUS PR.Y
0	SRP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1	SRP-MHIP	4.81	0.0	3.53	0.0	53.70	0.0	0.0	5.0	8.2	5.0	
2	STOMACH	4.21	-7.50	2.25	0.0	-64.20	0.0	0.0	5.0	6.9	5.0	
3	CHEST	4.22	7.50	6.42	0.0	4.80	0.0	0.0	5.2	7.2	5.2	
4	LWR NECK	4.21	-7.50	2.25	0.0	10.00	0.0	0.0	3.4	6.8	3.4	
5	UPR NECK	4.22	7.50	6.42	0.0	10.00	0.0	0.0	0.0	0.0	0.0	
6	MID HEAD	4.20	-4.60	0.16	0.0	-14.30	0.0	0.0	4.1	3.2	4.7	
7	MH-MEYE	4.23	4.60	8.52	0.0	90.00	0.0	0.0	0.0	0.0	0.0	
8	MEYE-REY	4.22	-3.93	-0.09	-90.00	90.00	0.0	0.0	0.0	0.0	0.0	
9	MEYE-LEY	4.21	3.93	8.76	90.00	90.00	0.0	0.0	0.0	0.0	0.0	
10	LN-MIDSS	4.22	-7.50	6.42	0.0	115.00	0.0	0.0	0.0	0.0	0.0	
11	MSS-RSS	4.21	7.50	2.25	-90.00	90.00	-25.00	0.0	0.0	0.0	0.0	
12	RSS-RSLD	4.22	-7.50	6.42	72.40	31.90	0.0	0.0	2.4	2.4	2.4	
13	RSLD-RLB	4.21	7.50	2.25	74.50	80.50	59.30	0.0	1.9	1.9	1.9	
14	RLB-RRST	4.23	-4.60	8.52	0.0	90.00	0.0	0.0	1.1	0.9	1.1	
15	RRST-RGR	4.20	4.60	0.16	0.0	0.0	0.0	0.0	2.2	0.6	4.1	
16	RRST-RFR	4.21	-3.93	8.76	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
17	RRST-RFT	4.22	3.93	-0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
18	MSS-LSS	4.22	-8.06	3.30	90.00	90.00	25.00	0.0	0.0	0.0	0.0	
19	LSS-LSLD	4.21	8.06	5.38	-72.40	31.90	0.0	0.0	2.4	2.4	2.4	
20	LSLD-LLB	4.20	-6.44	1.20	-74.50	80.50	-59.30	0.0	1.9	1.9	1.9	
21	LLB-LRST	4.23	6.44	7.47	0.0	90.00	0.0	0.0	1.1	0.9	1.1	
22	LRST-LGR	4.23	-4.66	0.18	0.0	0.0	0.0	0.0	2.2	0.6	4.1	
23	LRST-LFR	4.20	4.66	8.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
24	LRST-LFT	4.21	-8.06	5.38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
25	MHIP-RHP	4.22	8.06	3.30	-90.00	90.00	53.70	0.0	3.5	3.5	3.5	
26	RHP-RKNE	4.23	-6.44	7.47	90.00	90.00	0.0	0.0	2.3	2.3	2.3	
27	RKNE-RNK	4.20	6.44	1.20	-90.00	90.00	0.0	0.0	1.4	1.4	1.4	
28	RNK-RRCH	4.20	-4.66	8.49	0.0	-22.90	0.0	0.0	0.0	0.0	0.0	
29	MHIP-LHP	4.23	4.66	0.18	90.00	90.00	-53.70	0.0	3.5	3.5	3.5	
30	LHP-LKNE	1.23	0.0	8.40	-90.00	90.00	0.0	0.0	2.3	2.3	2.3	
31	LKNE-LNK	4.45	0.0	9.37	90.00	90.00	0.0	0.0	1.4	1.4	1.4	
32	LNK-LRCH	3.98	0.0	-0.70	0.0	-22.90	0.0	0.0	0.0	0.0	0.0	

Figure 17a. Print COMBIMAN Function Output.

COMBIMAN WORK/SPACE PANEL DATA

WORK/SPACE DATA IS ATE-01

	PANEL NAME	TYPE	VERTICIES		
1.)	LMIPAN	1			
			(29.75,	0.0 ,	5.94)
			(29.75,	14.75,	5.94)
			(31.34,	14.75,	13.39)
			(32.59,	9.57,	19.30)
			(33.20,	4.50,	22.14)
			(33.20,	0.0 ,	23.00)
2.)	RMIPAN	1			
			(29.75,	0.0 ,	5.94)
			(29.75,	-14.75,	5.94)
			(31.34,	-14.75,	13.39)
			(32.59,	-9.57,	19.30)
			(33.20,	-4.50,	22.14)
			(33.20,	0.0 ,	23.00)
3.)	FWDLHCON	1			
			(26.23,	9.25,	2.89)
			(26.23,	18.75,	2.85)
			(28.31,	18.01,	4.68)
			(29.79,	17.18,	5.93)
			(29.79,	9.28,	5.93)
4.)	LHCON	1			
			(26.09,	9.25,	2.76)
			(-8.40,	9.25,	2.76)
			(-8.40,	23.01,	2.76)
			(26.09,	20.00,	2.75)
5.)	AFTLHCON	1			
			(-3.35,	8.50,	2.76)
			(-8.53,	8.50,	2.76)
			(-8.53,	23.52,	2.76)
			(-3.40,	23.00,	2.75)
6.)	FWDRHCON	1			
			(26.23,	-9.25,	2.85)
			(26.23,	-18.75,	2.85)
			(28.31,	-18.01,	4.68)
			(29.79,	-17.18,	5.93)
			(29.79,	-9.28,	5.93)
7.)	RHCON	1			
			(26.09,	-9.25,	2.76)
			(-8.40,	-9.25,	2.76)
			(-8.40,	-23.53,	2.76)
			(26.09,	-20.00,	2.75)
8.)	CASWLFSD	1			
			(26.10,	9.25,	2.76)
			(-3.36,	9.25,	2.76)
			(-3.36,	9.25,	-9.32)
			(26.10,	9.25,	-9.32)

Figure 17b. Print COMBIMAN Function Output (Continued).

COMBIMAN WORK/SPACE CONTROL DATA

WORK/SPACE DATA IS A/E-01

NAME	TYPE	IN PANEL	POINT	ABSOLUTE COORDINATE	REL. COORDINATE
AFTPTLT	0		0	(-11.08, 26.00, 31.25)	(0.0 , 0.0)
AFTPTREA	0		0	(-29.58, 0.0 , 22.75)	(0.0 , 0.0)
AFTPTRT	0		0	(-11.08, -26.00, -99.13)	(0.0 , 0.0)
EMERPOWO	0		0	(25.89, 16.75, 6.54)	(0.0 , 0.0)
FCCATG	0		0	(20.59, 12.50, 8.00)	(0.0 , 0.0)
FCHKDOWN	0		0	(23.75, -16.02, 5.64)	(0.0 , 0.0)
FCHKUP	0		0	(26.49, -16.02, 7.93)	(0.0 , 0.0)
FCLDGGRU	0		0	(26.69, 10.43, 8.00)	(0.0 , 0.0)
FCRUDPDA	0		0	(27.84, 0.0 , 1.14)	(0.0 , 0.0)
FCSTKRPA	0		0	(16.47, 0.34, 11.26)	(0.0 , 0.0)
FCSTKRPM	0		0	(20.27, 0.34, 11.51)	(0.0 , 0.0)
FCTFADJ	0		0	(15.09, 5.75, 3.50)	(0.0 , 0.0)
FCTHRTLA	0		0	(11.16, 12.66, 7.04)	(0.0 , 0.0)
FCTHRTLM	0		0	(15.53, 12.66, 8.57)	(0.0 , 0.0)
FIADAI	0		0	(24.49, 5.43, 28.02)	(0.0 , 0.0)
FIHUD	0		0	(27.59, 0.0 , 27.79)	(0.0 , 0.0)
FISTBYCO	0		0	(31.83, -15.75, 16.18)	(0.0 , 0.0)
FWDPTLTD	0		0	(40.59, 35.00, 22.75)	(0.0 , 0.0)
FWDPTRTU	0		0	(40.59, -35.00, 34.75)	(0.0 , 0.0)
IMPOSSRC	0		0	(48.69, 0.0 , -0.90)	(0.0 , 0.0)
LONGLT	0		0	(6.11, 15.42, 12.84)	(0.0 , 0.0)
MAP CASE	0		0	(-8.90, -18.10, 6.84)	(0.0 , 0.0)
MSCANREL	0		0	(11.11, -14.42, 9.04)	(0.0 , 0.0)
NUTRLSRP	0		0	(0.01, 0.0 , 0.0)	(0.0 , 0.0)
RUDPDLAB	0		0	(28.69, 7.25, -4.56)	(0.0 , 0.0)
RUDPDLAN	0		0	(31.19, 7.25, -5.06)	(0.0 , 0.0)
RUDPDLAT	0		0	(33.69, 7.25, -4.56)	(0.0 , 0.0)
RUDPDLFB	0		0	(36.69, 7.25, -5.06)	(0.0 , 0.0)
RUDPDLFN	0		0	(39.19, 7.25, -5.56)	(0.0 , 0.0)
RUDPDLFT	0		0	(42.09, 7.25, -5.06)	(0.0 , 0.0)
RUDPDRAB	0		0	(28.69, -7.25, -4.56)	(0.0 , 0.0)
RUDPDRAN	0		0	(31.19, -7.25, -5.06)	(0.0 , 0.0)
RUDPDRAT	0		0	(33.69, -7.25, -4.56)	(0.0 , 0.0)
RUDPDRFB	0		0	(36.69, -7.25, -5.06)	(0.0 , 0.0)
RUDPDRFN	0		0	(39.19, -7.25, -5.56)	(0.0 , 0.0)
RUDPDRFT	0		0	(41.69, -7.25, -5.06)	(0.0 , 0.0)
SNDSEATE	0		0	(-0.06, 0.0 , -0.71)	(0.0 , 0.0)
SRP DOWN	0		0	(0.59, 0.0 , -1.90)	(0.0 , 0.0)
SRP UP	0		0	(-0.50, 0.0 , 2.67)	(0.0 , 0.0)
STDPOSLH	0		0	(270.59, 0.0 , -99.13)	(0.0 , 0.0)
STDPOSRH	0		0	(270.59, 0.0 , -99.13)	(0.0 , 0.0)
STDPOSLF	0		0	(270.59, 0.0 , -99.13)	(0.0 , 0.0)
STDPOSRF	0		0	(270.59, 0.0 , -99.13)	(0.0 , 0.0)
STDPOSEY	0		0	(270.59, 0.0 , -99.13)	(0.0 , 0.0)
WSARMREL	0		0	(29.08, 0.0 , 3.69)	(0.0 , 0.0)
WSBPC	0		0	(22.59, 13.50, 4.75)	(0.0 , 0.0)

Figure 17c. Print COMBIMAN Function Output (Continued).

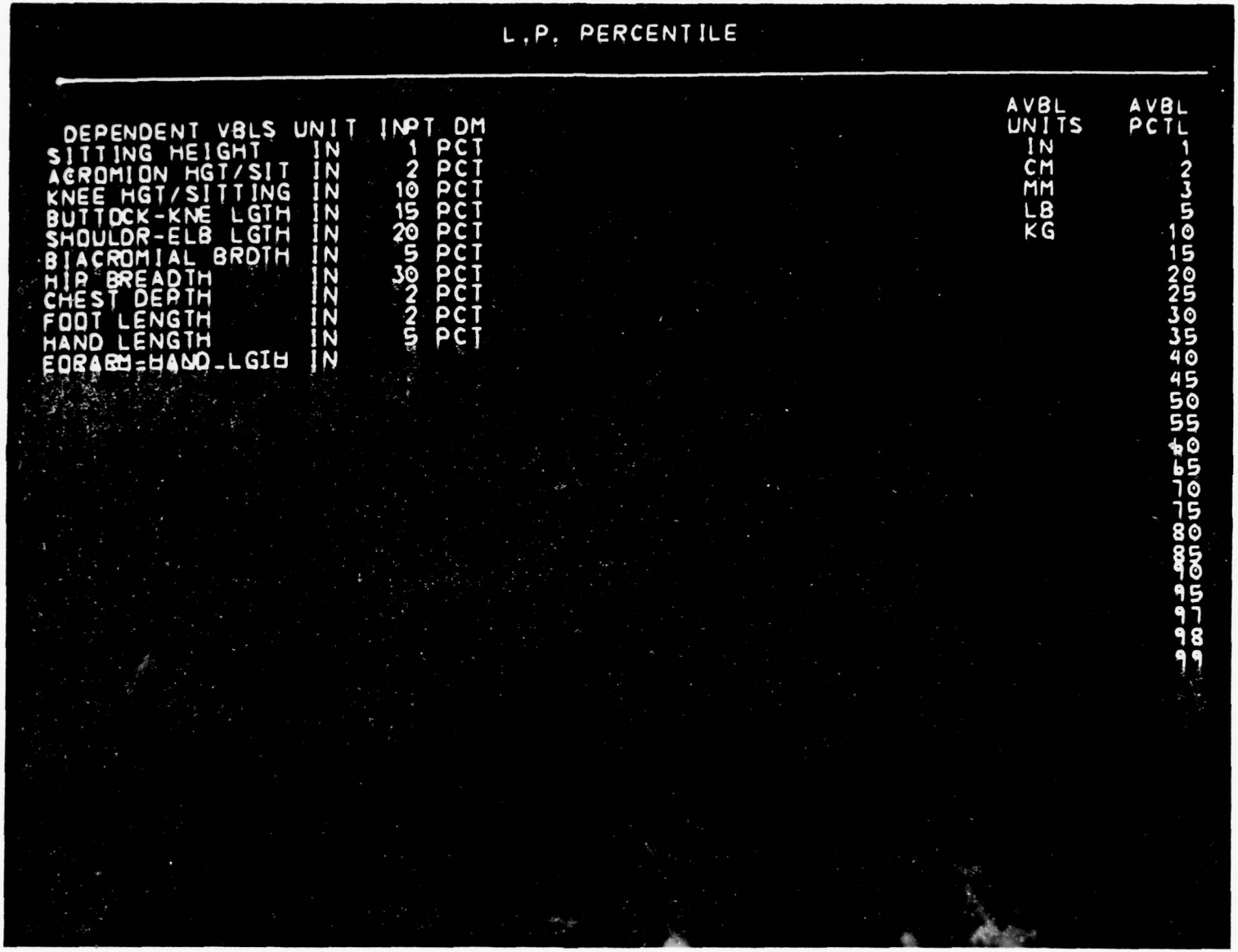

Figure 18. Dependent-Variable-Input CRT Screen Format.

may be either inches (IN), or centimeters (CM) or milimeters (MM). If the program-specified unit of measurement is to be retained, the user may respond to the message by pressing the ALT-CODE/5 sequence.

If State Switch 6 (see Paragraph 2.2.22) was activated prior to requesting new anthropometry, the dependent variable names, user input values and those values converted to the default unit of measurement are sent to a print file on disk to be written on the printer at the end of program CBM04. Sample output for the function is shown in Figure 19.

2.2.11 Input Two Independent Variables Function

The Input Two Independent Variables function gives the user the opportunity to select two anthropometric variables and enter values for each. One of these variables will be highly correlated to the mass variables of the model, and the other will be highly correlated to the length variables of the model. One of the key advantages of this function is the user need not have values in mind for all eleven dependent anthropometric dimensions, as with PFK12 (Paragraph 2.2.10). Instead, the user can select two key variables to suit his particular requirements, supply the values, and the program will calculate values for the remaining dependent variables through the use of regression equations which are part of the reference regression member. Values supplied by the user can be either percentiles or absolute dimensions. This function can be selected only after the user has depressed PFK4, 23 or 24.

The CRT is formatted as shown in Figure 20. The left and center portions of the screen contain the columns of mass and length related variables, respectively. To the right of each variable name is the default or predefined unit of measurement. The right portion of the screen contains a column of alternative units of measurement (labeled "AVBL UNITS"), and a column of percentile names (labeled "AVBL PCTL"), for which values can be obtained from the referenced survey member.

COMBIMAN ANTHROPOMETRIC DATA

REFERENCED SURVEY OF REGRESSION EQUATIONS IS REGRES01
REFERENCED SURVEY OF ANTHROPOMETRIC DIMENSIONS IS 67SURVEY

NO.	DEPNDNT VBL NAME	--USER INPUT- VALUE	UNIT	-CNVRTD DFLT- VALUE	UNIT
1	SITTING HEIGHT	95	PCT	38.800	IN
2	ACROMION HGT/SIT	90	PCT	25.510	IN
3	KNEE HGT/SITTING	85	PCT	22.960	IN
4	BUTTOCK-KNE LGTH	80	PCT	24.650	IN
5	SHOULDR-ELB LGTH	97	PCT	15.440	IN
6	BIACROMIAL BRDTH	95	PCT	17.260	IN
7	HIP BREADTH	2	PCT	12.410	IN
8	CHEST DEPTH	5	PCT	8.410	IN
9	FOOT LENGTH	90	PCT	11.250	IN
10	HAND LENGTH	98	PCT	8.210	IN
11	FORARM-HAND LGTH	40	PCT	19.120	IN

Figure 19. Printed Output Showing Selection of Dependent Variable Values.

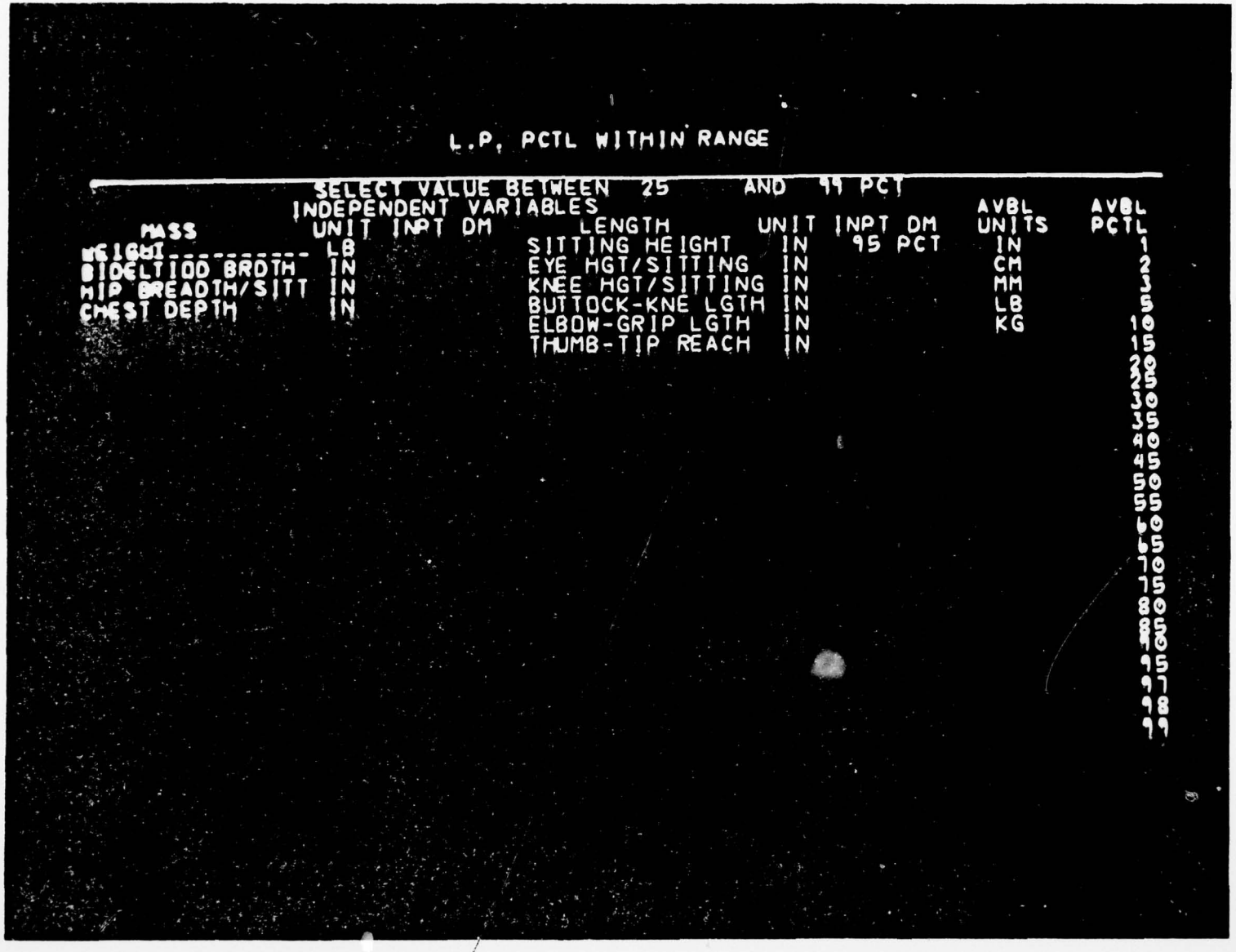

Figure 20. Independent-Variable-Input CRT Screen Format.

The first prompting message the user sees is "ENTER NEW STD ERROR". This standard error value is used in the equation in the routine which calculates the range of permissable values for the second independent variable selected. If the default value of 1.65 is retained, the range will include approximately 90% of all possible values for the variable. Increasing the standard error will increase the range; decreasing it will decrease the range. The value the user types in must be a real number, that is, include a decimal point, and must fall between -3. and +3. If the default value of 1.65 is suitable, the user may respond by depressing the ALT-CODE/5 sequence.

The next message asks "WILL VALUES BE IN PERCENTILES". If the user types "YES", values will be input by light penning a percentile from the column "AVBL PCTL". If the response was "NO" or just the ALT-CODE/5 sequence, values for the selected variables will be typed-in using the alphanumeric keyboard. For values to be input as percentiles, Table 1 shows the sequence of system messages and user responses to be followed. If the values are to input as absolute values via the alphanumeric keyboard the user should use Table 2 as a guide to the sequence of system messages and user responses. Once all the independent values have been supplied, the routine calculates the surface dimensions required to construct the link system of the model. These dimensions are calculated based on multiple regression equations in the referenced regression member and on the user supplied dimensions.

If State Switch 6 (see Paragraph 2.2.22) was activated prior to requesting new anthropometry, the two independent variables, their values as the user defined them, and their values converted to the preferred unit of measurement, will be written to a output file on disk, to be sent to the printer when the program CBM04 has ended. In addition, the dependent variable names and their calculated values will also be sent to the output file. Figure 21 is an example of this output.

TABLE 1

PROGRAM MESSAGES AND USER RESPONSES FOR PFK11 WHEN VALUES WILL BE INPUT AS PERCENTILES

(Program Responses Are Listed in Parenthesis)

PROGRAM MESSAGES	USER RESPONSES
L. P. FIRST INDEP VARIABLE	Light pen a variable from either mass or length column. (Selected variable will be underlined by program.)
L. P. PERCENTILE	Light pen percentile number from the column "AVBL PCTL" (Selected percentile will be displayed next to underlined variable.)
LP INDEP VBL IN OTHER COL	Light pen a variable from the column not selected the first time. (Selected variable will be underlined, if it is in the other column, and a permissible range of percentile values will be displayed in the information area.)
L. P. PCTL WITHIN RANGE	Light pen a percentile number from the column "AVBL PCTL" which lies within the range of values displayed. (Selected percentile will be checked and displayed next to underlined variable.)

TABLE 2

PROGRAM MESSAGES AND USER RESPONSES FOR PFK11
WHEN VALUES WILL BE INPUT AS ABSOLUTE DIMENSIONS

(Program Responses Are Listed in Parenthesis)

PROGRAM MESSAGES	USER RESPONSES
L. P. FIRST INDEP VARIABLE	Light pen a variable from either mass or length column. (Selected variable is underlined.)
ENTER NEW VALUE	Type in real number value via the alphanumeric keyboard, followed by the ALT-CODE/5 sequence. (Typed value will be displayed next to underlined variable.)
L. P. NEW UNIT, IF DESIRED	If a unit of measurement other than the one listed next to the underlined variable is desired, light pen a new unit from the column "AVBL UNITS". If no change is desired, press ALT-CODE/5 sequence. (The system checks that the unit is valid for the type of variable and displays it next to the input value.)
L. P. INDEP VBL IN OTHER COL	Light pen a variable from the column not selected the first time. (Selected variable will be underlined if it is in the proper column; a permissible range of absolute values in the preferred unit of the second variable will be displayed in the information area.)
ENTER NEW VALUE	Type in real number value within the displayed range, via the alphanumeric keyboard, followed by the ALT-CODE/5 sequence. (Typed value will be verified and displayed next to underlined variable.)
L. P. NEW UNIT, IF DESIRED	Press ALT-CODE/5 sequence. (Because the permitted range is in the preferred unit of measurement, and the value input must be within that range, it is not possible to change units for the second value at this time.)

COMBIMAN ANTHROPOMETRIC DATA

REFERENCED SURVEY OF REGRESSION EQUATIONS IS REGRESO1
REFERENCED SURVEY OF ANTHROPOMETRIC DIMENSIONS IS 67SURVEY

-USER SUPPLIED INDEPNDNT VALUES- VBL. NAME	VALUE	UNIT	-CNVRTD DFLT- VALUE	UNIT	
SITTING HEIGHT	95 PCT		38.800	IN	
WEIGHT	25 PCT		158.560	LB	SELECTED WITHIN RANGE 25 PCT TO 99 PCT

-----COMPUTER CALC. DEP. VALUES-----

NO.	VBL. NAME	VALUE	UNIT
1	SITTING HEIGHT	38.800	IN
2	ACROMION HGT/SIT	25.343	IN
3	KNEE HGT/SITTING	22.257	IN
4	BUTTOCK-KNE LGTH	23.583	IN
5	SHOULDR-ELB LGTH	14.436	IN
6	BIACROMIAL BRDTH	16.070	IN
7	HIP BREADTH	13.473	IN
8	CHEST DEPTH	8.833	IN
9	FOOT LENGTH	10.802	IN
10	HAND LENGTH	7.659	IN
11	FORARM-HAND LGTH	19.657	IN

Figure 21. Printed Output Showing Selection of Independent Variable Values.

The last message asked of the user by this function is "TABLE OF LINK DATA (Y/N)". If the user wants to scan the table of link data, which includes link names, lengths and transformation angles, and make changes, he should type "YES", then ALT-CODE/5. If not, he can press the ALT-CODE/5 sequence. Instructions on changing the contents of the table will be given in Paragraph 2.2.12.

2.2.12 Display Table Function

The Display Table function gives the user the opportunity to use existing anthropometric data and scan the table of link data and make changes to the values, as needed. Because the table displays calculated link lengths, the anthropometry of the model must have been defined previously. The table which is displayed is shown in Figure 22.

For each link in the man-model, the name, length and its percentile value, mass and its percentile value, and the link's transformation angles are displayed. The percentile values, mass, and centroid distances are not yet incorporated into the program and the values shown will always be zero. Modification of these values has no effect. The user can modify the values of the tables by light penning the value to change, typing a new value, and pressing ALT-CODE/5. When the user has finished making changes, he signals ALT-CODE/5 again. The transformation angles in this display can modified to place the man-model in whatever position desired.

2.2.13 Design Panel Function

The Design Panel function allows the user to add a workspace panel to the workspace (if any).

The user types a name, type code (currently ignored), sequence number, and number of vertices for the panel being defined, in response to prompting messages from the program. Then, with the light pen, program function key 22 (PFK22), and the light pen tracking symbol, the user defines the vertices of the panel.

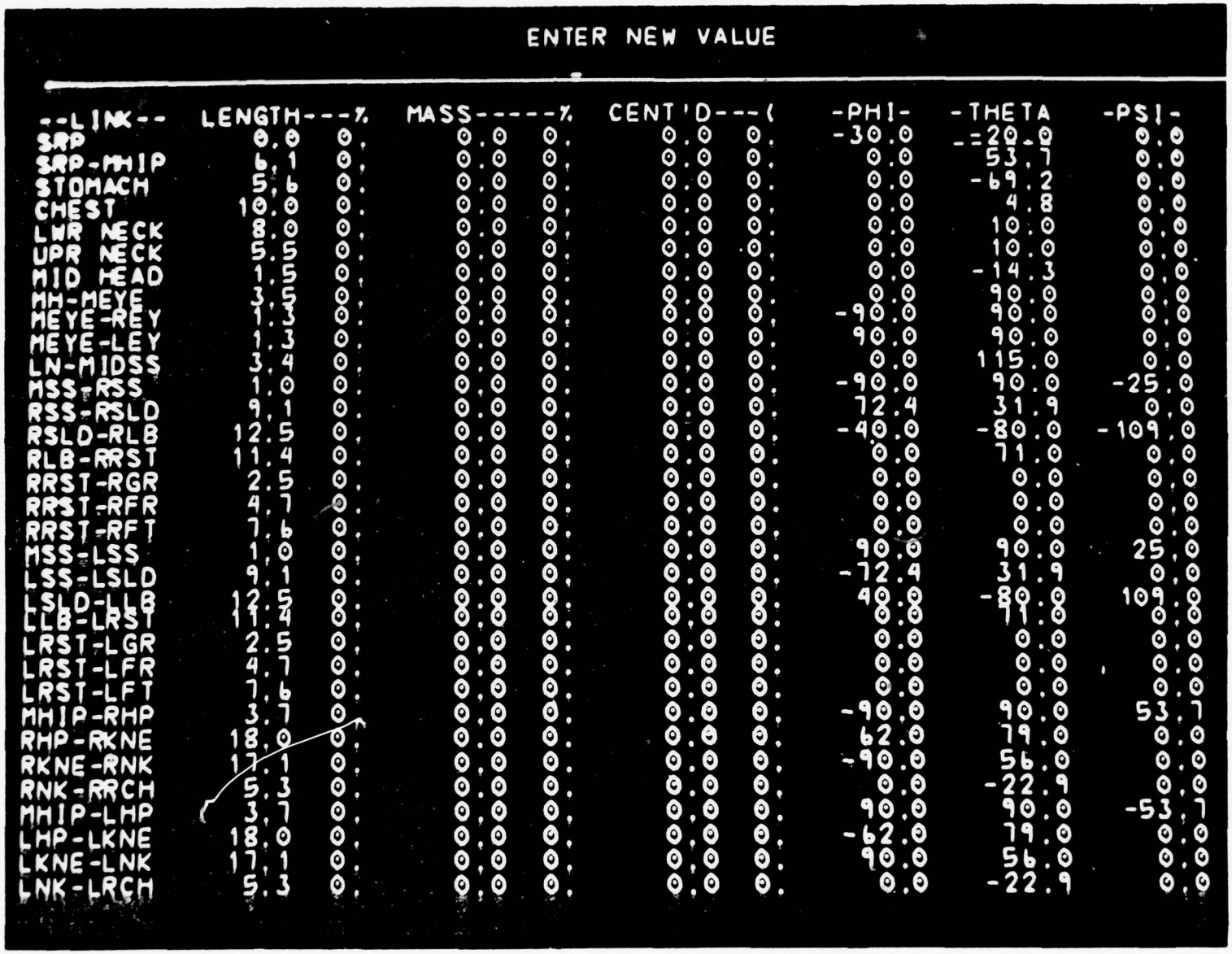

Figure 22. Table of Link Values as Shown on CRT Display.

For each vertex to be defined, the program displays a light pen tracking symbol (a series of dots) in the middle of the left view of the man-model and workspace. The user then moves the symbol about, using the light pen, until he has moved the symbol to the place where he wishes the vertex. Depressing PFK22 instructs the program to take this set of two-dimensional data into the x, y, and z coordinate computation for the vertex. The tracking symbol then appears in the right view in the center of a line. The line is drawn horizontally at the same height the tracking symbol was positioned on the left view when PFK22 was depressed. The user moves the symbol as before to the desired location on the line on the right side and again depresses PFK22. Only the horizontal component of the symbol location is used in the resultant x, y, and z coordinate computation. After the second and successive vertices are defined in the same manner, lines are drawn between vertices.

The panel thus defined can be treated as any other panel. It will not, however, be added to the workspace definition on the Workspace Data Base.

2.2.14 Define Control Function

The Define Control function allows the user to add a workspace control to the current workspace (if any).

The user types a name and a type code, and light pens a location for the control in the same fashion as for a panel being defined in the Design Panel function.

The control, once defined, can be manipulated as any other control, but it will not be added to the workspace definition on the Workspace Data Base.

2.2.15 Delete Panel Function

The Delete Panel function allows the user to remove a workspace panel from the current workspace in memory. It does not remove the panel from the associated member in the Workspace Data Base. Once

deleted, the panel cannot be recalled. It must be either recreated via the Design Panel function, or retrieved via the Retrieve Workspace function.

To delete a panel, the name of the panel must be typed via the alphanumeric keyboard. If the panel specified does not exist, the program repeats the prompt until the user specifies an existing panel, or signals ALT-CODE/5. If no name is specified by signaling only ALT-CODE/5, the function request is ignored and no deletion occurs.

2.2.16 Delete Control Function

The Delete Control function allows the user to remove a workspace control from the current workspace in memory. It does not remove the control from the workspace definition in the Workspace Data Base. Once deleted, the control cannot be recalled using the Include Object function. It must either be recreated via the Define Control function or re-retrieved via the Retrieve Workspace function.

To delete a control, the name of the control must be specified via the alphanumeric keyboard. If the control specified does not exist, the program repeats the prompt until an existing control name is given by the user or no name is specified by pressing only ALT-CODE/5. If no name is specified, the function request is ignored, and no action (deletion of controls) occurs.

2.2.17 Change Panel Function

The Change Panel function allows the user to change a workspace panel. Changes permitted are change in name, change in type, change in sequence number, and change in the location of any or all vertex locations.

The user is asked to specify the current name of the panel he wishes to change. Then the program asks for a new name, new type, and new sequence number, and if he desires to change the location of any vertex. If no changes for a particular item are to be made, the user merely presses ALT-CODE/5 without giving a reply. Changing the location of a vertex is

done by light penning the line whose end point constitutes the vertex to be changed. The new location is then specified in the same manner as vertices are defined in the Design Panel function. After each vertex is redefined, the program redraws the affected panel with the change. After the last vertex has been redefined, the user indicates he is finished by pressing ALT-CODE/5.

None of the changes made by this function affect any members of the Workspace Data Base.

2.2.18 Change Control Function

The Change Control function allows the user to change a workspace control. Changes permitted are change in name, change in type, and change in location.

The user is asked to specify the current name of the control he wishes to change. The program asks for a new name and new type, and if the user desires to change the location of the control. If no change is desired for a particular item, the user simply presses ALT-CODE/5. Redefining the location of a control is done in the same fashion as controls are defined in the Define Control function.

None of the changes made by this function affect any member of the Workspace Data Base.

2.2.19 Note Light Pen Location Function

The Note Light Pen Location function enables the user to select points on the orthogonal views of the display area of the screen which will be converted to real-world x, y, and z coordinates to define vertex and control positions. The function can be used only after PFK16, 17, 20, or 21 have been activated. A more detailed description of the use of the function is described in Paragraph 2.2.13.

2.2.20 Reset Slumped Posture Function

As shown in Figure 10, the Reset Slumped Posture function is one of the three which may be activated to generate the model. Prior to asking the user for regression and survey member names, the function resets the transformation angles of the model so it will assume a slumped posture, like that shown in Figure 23. The function then passes control to the routine used by the Retrieve Anthropometry function. The user should refer to Paragraph 2.2.5 for all program messages and user responses required to specify the anthropometry and generate the model.

2.2.21 Reset Reach Posture Function

As shown in Figure 10, the Reset Reach Posture function is one of the three which may be activated to generate the model. Prior to asking the user for regression and survey member names, the function resets the transformation angles of the model so it will assume an extended reach posture, like that shown in Figure 24. The function then passes control to the routine used by the Retrieve Anthropometry function. The user should refer to Paragraph 2.2.5 for all program messages and user responses required to specify the anthropometry and generate the model.

2.2.22 Switch State Function

The Switch State function allows the user to specify what state he wishes the program to run in. Table 3 shows the various swtiches available and the meanings of their state.

When this function is invoked, the user specifies which state switch he wishes to change by typing the integer number, right justified in a eight character field. The switch number is followed by pressing ALT-CODE/5. The state of the switch is specified by typing "ON" or "OFF" followed by pressing ALT-CODE/5.

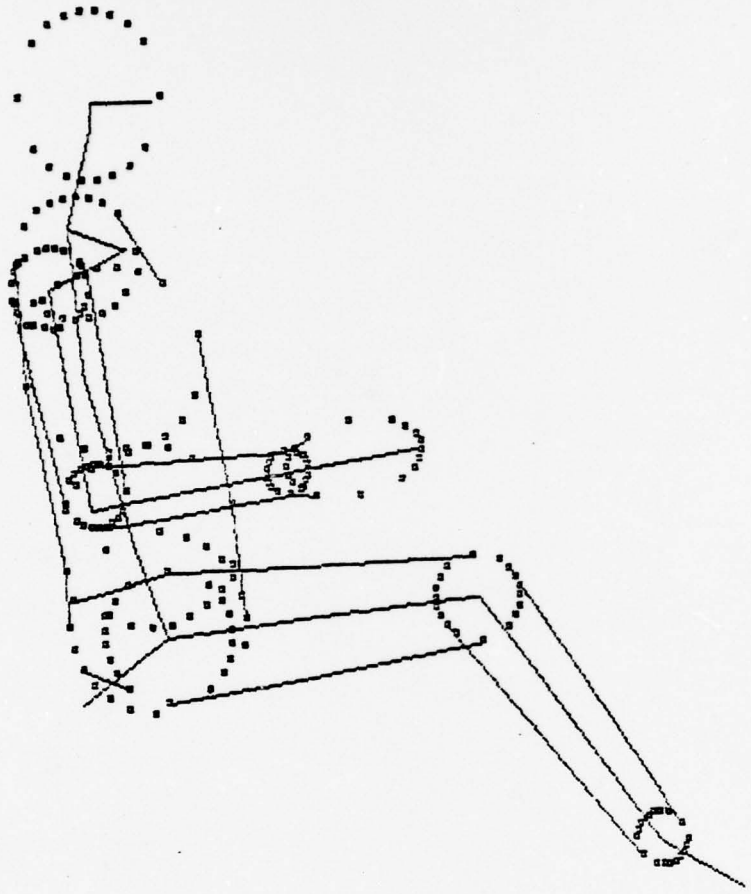

Figure 23. Side View (X-Z Plane) of Model in Slumped Posture.

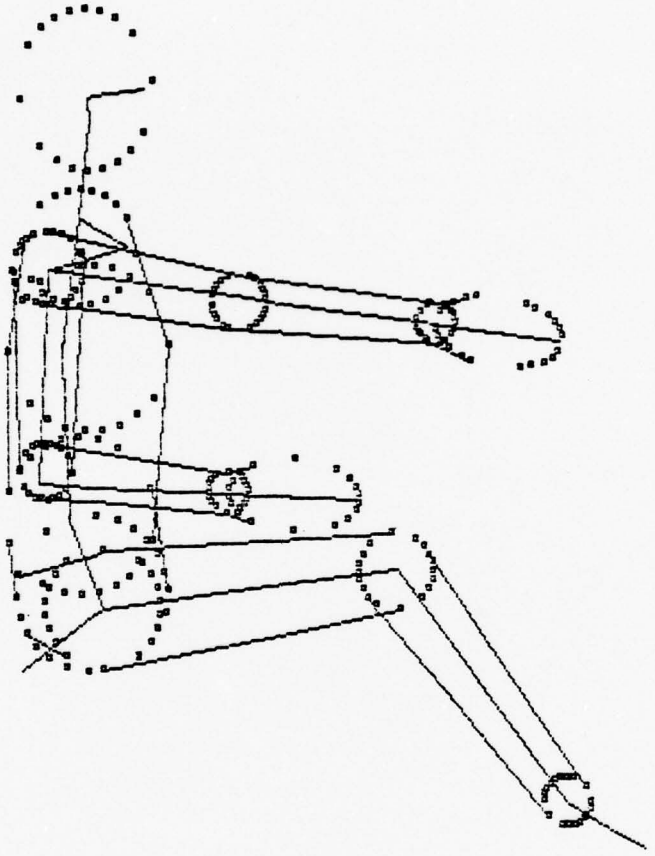

Figure 24. Side View (X-Z Plane) of Model in Extended Reach Posture.

TABLE 3

PROGRAM CBM04 STATE SWITCHES

SWITCH NUMBER	IF ON	IF OFF
1	Shoulder Harnesses Operator.	No Shoulder Harness for Operator.
2	Prints Messages CBM006I and CBM007I (See Paragraph 2.4).	Messages CBM006 and CBM007 suppressed.
5	No enfleshment on model.	Enflesh COMBIMAN model.
6	Print surface dimensions and internal links as calculated. (As in Figure 19 and Figure 21.)	Suppress printing of surface and link length data.
11	Generate enfleshment points for x-y viewing plane, as well as x-z and y-z planes.	Calculate points for x-z and y-z planes, only.
72	Matrices (link) printed, as shown in Figure 13.	No matrices printed.
3- 4 7-10 12-71	*Reserved.*	

2.2.23 Restart Program Function

The Restart Program function allows the user to start program CBM04 over again as though the program were being re-executed.

2.2.24 End Program Function

The End Program function allows the user to stop execution of program CBM04 and let the control of the computer return to the Operating System.

2.3 EXECUTING THE JOB

This sequence is intended to assist the user in loading the program CBM04, specifying processing, handling error procedures, obtaining output, and ending the program. It will not describe data formats and program functions as these were described in detail in Paragraph 2.2 of this section.

2.3.1 Loading the Program CBM04

Prior to loading the program CBM04, the user should check to be sure all the devices and files required by the program are available. The files which are needed are shown in Table 4. Normally, all the devices will be available on the HESS Facility, especially if other jobs have been running. The graphics unit specified on the FT10 card must be enabled. This may be accomplished by pressing the white "POWER ON" button to the right of the display unit to be used. If plots are to be generated, the Gould plotter should be enabled and ready. It will generally be enabled, but the user should push down on the two white buttons on top of the plotter to be sure the paper is loaded properly. If any of the devices are not enabled when they are called by the program, the program will terminate automatically.

In addition to checking the units required by program CBM04, the user should be sure that a large enough partition of computer memory exists in which to run the job. To insure this, the user should follow these

TABLE 4

PROGRAM CBM04 FILES AND ASSOCIATED FORTRAN IV UNIT NUMBERS

FORTRAN IV UNIT #	DEVICE CLASS*	DESCRIPTION	USED BY	BCD/ BINARY	INPUT/ OUTPUT
1	SQ	Initialization Data	CBMINT	Binary	Input
2	DA	Anthropometric Data Base	CBMIN1	Binary	Input
3	DA	Workspace Data Base	CBMWSR	Binary	Input
4	DA	Task Data Base	CBMTSK	Binary	Input
5	UR	Not Used; Reserved		BCD	Input
6	UR	Printed Output	(Many)	BCD	Output
7	UR	Punched Output (Not Used)		BCD	Output
8	SQ	Audit Trail	(Many)	BCD	Output
9	SQ	Workspace Outline	CBMVIS	Binary	Output
10	GR	Graphical Display	(GSP)	Binary	I/O
11-15		(Reserved)			
SYSPLOT	PL	Plot Data	Many	Binary	Output

*SQ - Sequential Device, like tape, cards, printer.
DA - Direct Access, like disc, drum.
GR - Graphical Display Device.
UR - Unit Record Device, like cards, printer, etc.
PL - Electrostatic Plotter.

System Action: The request for a regression name is repeated.

steps while sitting in front of the typewriter-like console (Unit 01F) at the IBM 370/155 Central Processing Unit (CPU):

1) Hit the [REQUEST] button, when the PROCEED light comes on, type:

   n␣ list

   and hit the [END] button.

   (The symbol ␣ indicates one depression of the space bar.)

2) Wait for the system to respond with a partition definition followed by the message, 00 IEE802A ENTER DEFINITION.

3) Hit the [REQUEST] button and type:

   r␣00, p0=(cd, 280k), [END]

   [REQUEST] r␣00, p1=(wtr, 18k), [END]

   [REQUEST] r␣00, p2=(ab, 10k), p2=last, end [END]

4) Go to the card reader, lift the card weight off the input hopper and place a stack of about 10 end-of-job cards (cards with only // punched in the first two columns) in the hopper, with the bottom edge down and away from you. Replace the weight, hit the START and END-OF-FILE buttons on the reader and wait for the cards to be read through.

5) Wait for the system to complete the partition definition and respond with the message "IEE805I DEFINITION COMPLETED" on the console.

6) Type the following sequence on the console:

   [REQUEST] s␣wtr.p1, 00e [END]

   [REQUEST] s␣rdr.s, 00c [END]

   [REQUEST] s␣init.all [END]

CBM043I USER CHOOSES TO INPUT nn DEPENDENT VARIABLES.
Issued By: CBMDEP.

7) Wait for the message "IEF403I RDR STARTED" to be typed on the console.

The user can now load the deck labeled CBM04R. The Job Control Cards contained in the deck are shown in Figure 25. The user should go to the card reader and remove the weight from the hopper. Place the deck followed by about 10 end of job cards in the hopper with the bottom edges of the cards facing down and away. Replace the weight over the deck and press the START button on the card reader. Wait for the deck to be read through and for the message "IEF403I CBM04R STARTED" to be printed at the console. The program is now loaded and in about 30 seconds, the screen format similar to that shown in Figure 6 should appear on the CRT unit specified in the FT10 card.

2.3.2 Selecting Functions and Entering Data

Once the program has been loaded, theCRT screen has been formatted, and the message "DEPRESS PFK" appears in the prompting area of the screen, the user can begin processing by momentarily depressing the appropriate lighted function key on the Program Function Keyboard. Explanation of the processing performed by each anabled or lighted function key is explained in Paragraph 2.2.

The program does not receive any input data via computer cards. All data is kept on data bases created and maintained by the program CBMAM and CBMWM (see Sections 3 and 4). The user may select from these data or may modify them to suit the situation. All interaction with the program is done via the devices of the CRT, that is the Program Function Keyboard, the Alphanumeric Keyboard, or the Light Pen.

2.3.3 Error Procedures

The program CBM04 performs some preliminary error checking as the user supplies data to the program. The majority of the checking is for data values which are outside the limits specified by the program. For example,

```
//CBM04R  JOB (UDR807,K0),EVANS,MSGLEVEL=1,CLASS=D
//JOBLIB DD DSN=COMBIMAN.LINKLIB,DISP=OLD
//COMBIMAN EXEC PGM=CBM04
//SYSUT1     DD  SPACE=(TRK,(40)),UNIT=SYSDA
//FT01F001 DD DSN=SME.INITDATA,DISP=OLD
//FT02F001 DD DSN=COMBIMAN.ANTHDATA,DISP=OLD
//FT03F001 DD DSNAME=COMBIMAN.WKSPDATA,DISP=SHR
//FT04F001 DD DSNAME=COMBIMAN.TASKDATA,DISP=SHR
//FT05F001 DD DDNAME=SYSIN
//FT06F001 DD SYSOUT=A
//FT07F001 DD DUMMY
//FT08F001 DD DISP=(,PASS),SPACE=(1210,(25,10)),UNIT=SYSDA,
//        DCB=(LRECL=121,RECFM=FB,BLKSIZE=1210)
//FT09F001 DD DSN=SME.VISDATA,DISP=OLD
//FT10F001 DD UNIT=1E0
//SYSPLOT     DD  UNIT=GOULD
//SYSPOUT     DD  SYSOUT=A
//SYSIN DD *
/*
//PRINT EXEC PGM=IEBGENER,COND=EVEN
//SYSUT1 DD DSN=*.COMBIMAN.FT08F001,DISP=(OLD,DELETE)
//SYSUT2 DD SYSOUT=A,DCB=(BLKSIZE=121,RECFM=FA)
//SYSPRINT DD DUMMY
//SYSIN DD DUMMY
/*
//
```

Figure 25. Job Control Cards for Program CBM04R.

State Switch numbers must be between 1 and 72, the maximum number of panels for any workstation configurations to be displayed cannot exceed 250, and all man-model dimensional data entered must be positive values. If the user should light pen or type in values out of range, the prompting message will inform him of this and ask for him to retry the entry. Other limitations have been discussed in the appropriate areas of Paragraph 2.2.

When specifying alphanumeric data, the user can expect the program to perform error checking when the name or title can be checked against lists of valid names or titles. For example, workspace member names will always be checked against the member directory to assure a valid name. However, if the user is creating a panel or control and specifying a new name, the user is responsible for noting the name as typed for future manipulations to the panel or control.

When typing numeric data, care should be taken to type a decimal point, not a comma, as the program CBM04 does not check for this, but the IBM System does. Automatic termination of the program could result from such typing errors, if not corrected before the entry is sent to the program (i.e., signaling the ALT-CODE/5 sequence).

If a character is incorrectly typed when inputting data via the alphanumeric keyboard, it is possible to backspace the cursor (an underbar character) to the character in question and retype from the incorrect space on the end. The backspace key is on the top row of the keyboard, to the right. Where appropriate, error messages are sent to an output file for printing after the completion of Program CBM04. The message numbers and formats are listed and described in Paragraph 2.4.

2.3.4 Obtaining Output Data

Printed output of the program CBM04 is sent to a disk file while the program is running. The file is automatically sent to the printer at the end of the job. Two types of output may be generated by the program. The first type varies in length depending on the user's selection of appropriate

State Switches and the activity of the Print COMBIMAN function key. The formats for this type were described in the appropriate sections of Paragraph 2.2. Generally, this type of output gives the user information on user selection of anthropometric variables and values, computer calculated link and enfleshment data, and three-dimensional workstation configurations.

The second type lists actions taken by the user in the form of an activity log. The messages of this log are sent to a separate disk file and printed as a separate job step in the CBM04R deck. A sample activity log is shown in Figure 26.

2.3.5 Ending the Program

The main method for normally terminating the program is to use the END program function key. Another method to terminate execution of the program is to use the CANCEL key on the IBM 2250 Display Unit. When this key and the ALT CODING key are depressed, the Operating System displays three options, one of which is to be light penned. This display is seen in Figure 27.

Light penning the TERMINATE option terminates the program without producing a memory dump of the program CBM04. The DUMP option terminates the program and dumps the contents of the partition of memory occupied by the program. RESUME resumes the execution of program CBM04 as though the CANCEL key had not been used.

Either the use of the END program function key, or the Cancel key on the ANKB should cause the CRT display to go blank and the message "IEF 404I CBM04R ENDED" to appear on the console typewriter. If the message does not appear within 60 seconds after ending the program, the program may be cancelled by pressing the REQUEST key on the console, typing "c_{Δ}CBM04R", and pressing the END key. The above message should then appear, and all printed output will be sent to the printer.

```
CBM001I COMBIMAN V4, DATE=12/27/76, TIME=14.44.31.
CBM033I REGRESSION VALUES FROM MEMBER REGRES01.
CBM015I SURVEY DATA FROM 67SURVEY
CBM040I USER CHOOSES TO INPUT 2 INDEPENDENT VARIABLES.
CBM041I INPUT VARIABLES WILL BE IN PERCENTILES.
CBM092I VISIBILITY PLOT GENERATED SUCCESSFULLY.
CBM033I REGRESSION VALUES FROM MEMBER          .
CBM015I SURVEY DATA FROM
CBM040I USER CHOOSES TO INPUT 2 INDEPENDENT VARIABLES.
CBM041I INPUT VARIABLES WILL BE IN PERCENTILES.
CBM033I REGRESSION VALUES FROM MEMBER          .
CBM015I SURVEY DATA FROM
CBM033I REGRESSION VALUES FROM MEMBER          .
CBM015I SURVEY DATA FROM
CBM092I VISIBILITY PLOT GENERATED SUCCESSFULLY.
CBM033I REGRESSION VALUES FROM MEMBER          .
CBM015I SURVEY DATA FROM
CBM092I VISIBILITY PLOT GENERATED SUCCESSFULLY.
CBM002I PROGRAM END.
```

Figure 26. Sample Activity Log.

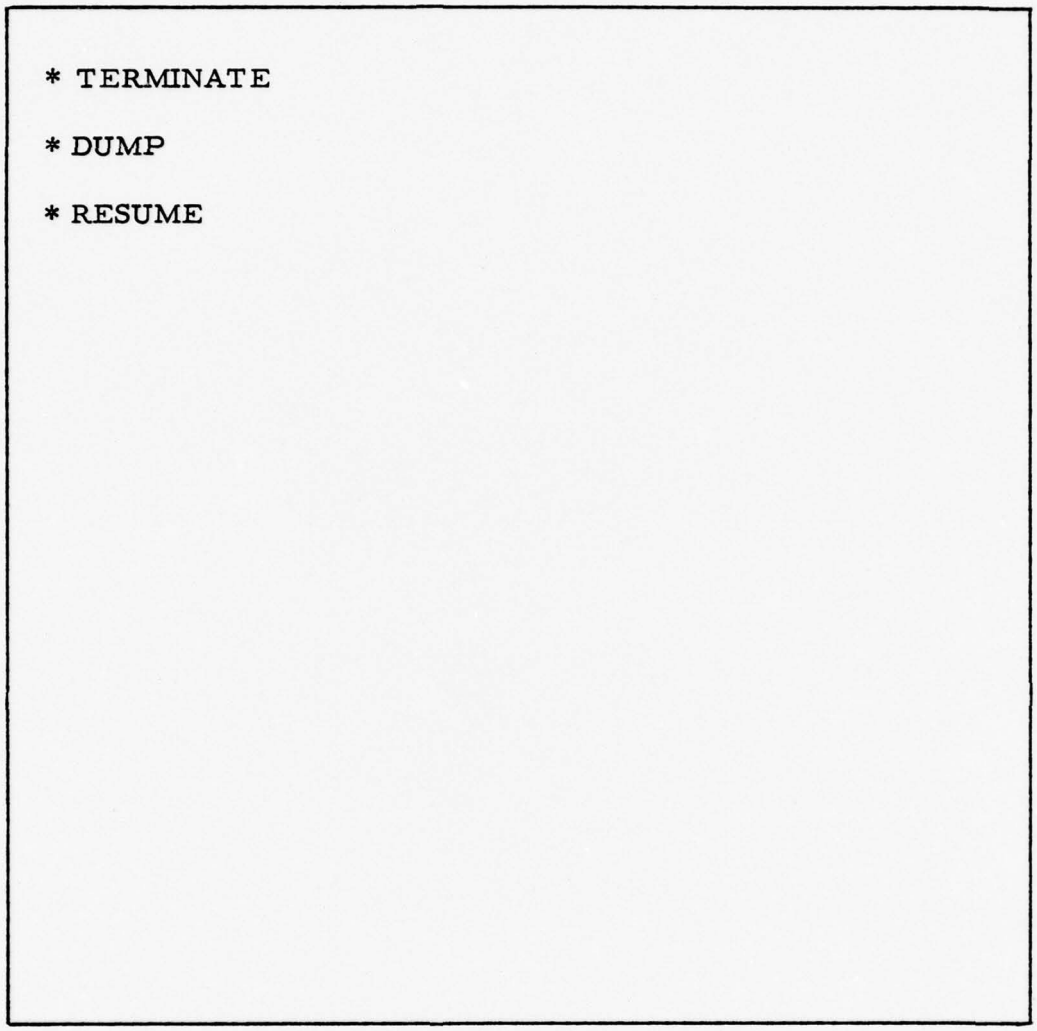

Figure 27. Cancel Key Options of the Operating System.

2.4 PROGRAM MESSAGES-INFORMATION AND ERROR TYPE

The program CBM04 prints out both instructional and action messages. The message format for both is as follows:

CBM0nni Message Text

where:

- CBM - identifies the message as coming from the COMBIMAN system,
- 0 - identifies the program in which the message was issued, in this case, CBM04,
- nn - is the message number,
- i - is the action code (I=informational, A=action to be performed), and
- message text - is the message text.

The messages in effect to date are as follows:

CBM001I COMBIMAN V4, DATE=yy.ddd, TIME=hh.mm.ss.
Issued By: CBMINT.
Reason: Program CBM04 has been executed. The date and time are that of invocation.
System Action: Execution continues.
User Action: None.

CBM002I PROGRAM END.
Issued By: CBMRTS.
Reason: The user either requested the End Program function or the Restart Program function.
System Action: The program is either ended or restarted as requested.
User Action: None.

CBM006I control name, TYPE=nn, XYZ=(nn.nn, nn.nn, nn.nn)
Issued By: CBMWSR.
Reason: The user has defined a control to the system via the Workspace Retrieval function or the Define Control function.
System Action: The control definition is accepted.
User Action: None.

CBM007I nnn.) panel name, HIERARCHY=nn, TYPE=nn, nn VERTICES.
CBM007I nn.nn nn.nn nn.nn nn.nn nn.nn nn.nn nn.nn nn.nn nn.nn
CBM007I nn.nn nn.nn nn.nn

Issued By: CBMWSR.

Reason: The user has defined a panel to the system via the Workspace Retrieval function or the Design Panel function.

System Action: The defined panel is accepted.

User Action: None.

CBM008A W/S MEMBER membername NOT FOUND.

Issued By: CBMWSR.

Reason: User requested the program via the Workspace Retrieval function to retrieve the workspace named membername, but that member was not found on the workspace data base.

System Action: A new membername is requested of the user. Retrieval is attempted under the new name.

User Action: Respond with a membername that exists, or (EOB) to cancel retrieval function.

CBM009I SWITCH switchnumber ON/OFF

Issued By: CBMSSW.

Reason: The user requested a program switch change via the Switch State function.

System Action: The switch numbered switchnumber is now either "ON" or "OFF".

User Action: None.

CBM010I IDENTIFIED objectname

Issued By: CBMIOI.

Reason: The user requested the Identify Object function to identify an object displayed on the screen.

System Action: The system displays on the screen the object's name, distal-end coordinates and internal "key" number.

User Action: None

CBM011I OMITTED objectname

Issued By: CBMIOI.

Reason: The user requested that an object be removed temporarily from the display via the Omit Object function.

System Action: The object light penned is removed from the screen, and that object's name, distal-end point coordinates and internal "key" number are displayed on the screen.

User Action: Record the internal "key" number in order to include the object back in the display.

CBM012I INCLUDED objectname
Issued By: CBMIOI.
Reason: The user requested that an object be included back into the display via the Include Object function.
System Action: The requested object was included back into the display.
User Action: The user specified the internal "key" number of the object to be included.

CBM013I TASK DATA FROM membername
Issued By: CBMTSK.
Reason: The user requested the retrieval of a task definition member via the Task Performance function. The member of the Task Data Base to be retrieved is membername.
System Action: The specified task definition is retrieved.
User Action: None.

CBM014I W/S DATA FROM membername
Issued By: CBMWSR.
Reason: The user requested the retrieval of a workspace definition via the Retrieve Workspace function.
System Action: The requested workspace member is retrieved.
User Action: None.

CBM015I SURVEY DATA FROM membername
Issued By: CBMIN1.
Reason: The user requested survey data known by membername from the Survey Data Base.
System Action: The requested survey data is retrieved.
User Action: None.

CBM016I VIEW=(roll, pitch, yaw), SCALE=factor, OFFSET=(x, y, z).
Issued By: CBMDSP.
Reason: The user requested a new view via the Change View function.
System Action: The display is rotated as specified.
User Action: None.

CBM018I INITIALIZATION DATA MISSING.
Issued By: CBMINT.
Reason: Data that was to have been for initialization was not present.

System Action: The program is terminated.
User Action: Check to see that the initialization data has not been destroyed. Possibly rerun program CBMIC.

CBM019I PLOTS COMPLETED.
Issued By: CBMCP1.
Reason: The user has requested that a hard copy plot of the COMBIMAN display be made. The hard copy plot is finished.
System Action: None. Plotting is finished.
User Action: None.

CBM020I lefthand, righthand, eyes, leftfoot, rightfoot, timedelay, timeallocated.
Issued By: CBMTSK.
Reason: A task step was specified to the system via the Perform Task function for COMBIMAN to perform. Lefthand, righthand, leftfoot, rightfoot are the control locations in which the hands and feet are to be placed. The eyes are to view control eyes. There is a delay time of timedelay minutes before the task step is to be performed. The task step is allocated timeallocated minutes for completion.
System Action: The system attempts to move the hands and feet, and have the eyes viewing the specified control locations within the specified time (timeallocated).
User Action: None.

CBM021A TASK MEMBER membername NOT FOUND.
Issued By: CBMTSK.
Reason: The user has requested that the task definition member, membername, in the Task Definition Data Base be retrieved, but the member could not be found.
System Action: Another task definition member name is requested, and retrieval continues with the new name.
User Action: Check to see that the task definition member membername has not been destroyed.

CBM022A TOO MANY PLANES/VERTICES.
Issued By: CBMWSR.
Reason: More panels were attempted to be defined to the system via the Retrieve Workspace function (PFK05) or the Define Panel function (PFK16) than could be handled at one time. The maximum number of panels that can be handled at one time is about 250.
System Action: The panel being defined is ignored unless some are deleted before hand.

User Action: Delete a few panels via the Delete Panel function (PFK18) and then retry to define more panels.

CBM023A ANTHROPOMETRIC SURVEY MEMBER membername, TYPE t, NOT FOUND.
Issued By: CBMIN1.
Reason: The user requested the survey data member membername be retrieved, but that member could not be found on the Survey Data Base.
System Action: Another survey data member name is requested, and retrieval continues using the new name.
User Action: Check that the survey data member membername has not been destroyed.

CBM024A CONTROL controlname NOT FOUND.
Issued By: CBMTK1.
Reason: The user has in a task step referred to control location controlname but controlname has not been defined.
System Action: The user is asked for a new control name or "IGNORE". The new control name is used instead of controlname. If "IGNORE" is replied, the system uses a default control name.
User Action: Check to see that controlname was defined.

CBM026I DELETE PANEL panelname
Issued By: CBMWSR.
Reason: The user has requested via the Delete Panel function to delete panel panelname.
System Action: The panel is deleted.
User Action: None.

CBM027I DELETE CNTRL PNT controlname
Issued By: CBMSWR.
Reason: The user has requested via the Delete Control function to delete control controlname.
System Action: The control is deleted.
User Action: None.

CBM028I CHANGE PANEL panelname
Issued By: CBMWSR.
Reason: The user has changed the panel panelname via the Change Panel function.
System Action: The requested changes have been made.
User Action: None.

CBM029I CHANGE CNTRL PNT controlname.
Issued By: CBMWSR.
Reason: The user has changed the control controlname via the Change Control function.
System Action: The requested changes have been made.
User Action: None.

CBM030A TASK DATA BASE MISSING.
Issued By: CBMTSR.

CBM031A WORKSPACE DATA BASE MISSING.
Issued By: CBMWSR.
Reason: Identification record of the file which is to contain workspace data does not check out.
System Action: Displays similar message to CRT and returns control to main program.
User Action: Stop program, if workspaces are needed; call systems programmer.

CBM033I REGRESSION VALUES FROM MEMBER membername.
Issued By: CBMIN1.
Reason: User has entered a valid regression or type 0 anthropometric data base membername.
System Action: Data from the referenced member is read into arrays.
User Action: None.

CBM034A ANTHROPOMETRIC DATA BASE MISSING.
Issued By: CBMIN1.
Reason: The identification record of the file which is supposed to contain anthropometric data does not check out.
System Action: Displays similar message to CRT operator and returns control to main program.
User Action: Stop program; create anthropometric data base.

CBM035A VARIABLE NO. nn OF REGRESSION SURVEY membername HAS INVALID UNIT OF uu.
Issued By: CBMIN1.
Reason: The unit of measurement read in for the specified variable and survey was not either IN, CM, MM, LB, or KG.
System Action: Remainder of data for variable is read in.
User Action: Report condition to systems programmer.

CBM036A NO REGRESSION MEMBER WAS SPECIFIED.
Issued By: CBMIN1.
Reason: The user did not enter a regression membername when asked, and when one was needed.

System Action: The request for a regression name is repeated.
User Action: Supply a regression membername.

CBM037A NO SURVEY MEMBER WAS SPECIFIED.
Issued By: CBMIN1.
Reason: The user did not enter a survey membername when asked, and when one was needed.
System Action: The request for a survey member is repeated.
User Action: Supply a survey membername.

CBM038A NO ANTHROPOMETRIC LINK DATA EXISTS.
Issued By: CBMIN1.
Reason: User asked to see table of link data but has failed to enter anthropometric data prior to this request.
System Action: Requests anthropometric data.
User Action: Enter anthropometric data.

CBM039I UNIT OF VARIABLE vblname HAS BEEN CHANGED TO uu.
Issued By: CBMIND, CBMDEP.
Reason: The user changed the default unit of measurement of the specified variable.
System Action: Flag the unit as being changed.
User Action: None.

CBM040A INVALID UNIT OF uu SPECIFIED FOR VARIABLE vbl name.
Issued By: CBMIND, CBMDEP.
Reason: The variable in question was defined in the anthropometric survey as having a length or weight type of measurement. The unit specified by the user was not consistent with the original definition.
System Action: Changed ignored.
User Action: Respecify unit or keep default unit.

CBM041I INPUT VARIABLES WILL BE IN PERCENTILES.
Issued By: CBMIND, CBMDEP.
Reason: User has indicated that values for dimension will be given as percentiles.
System Action: None.
User Action: None.

CBM042I INPUT VARIABLES WILL BE IN ABSOLUTE VALUES.
Issued By: CBMIND, CBMDEP.
Reason: User has indicated that values for variables will be given as actual dimensions.
System Action: None.
User Action: None.

CBM043I USER CHOOSES TO INPUT nn DEPENDENT VARIABLES.
Issued By: CBMDEP.
Reason: User has depressed function key, indicating decision to enter values for all the dependent variables.
System Action: None.
User Action: None.

CBM044I STANDARD ERROR MULTIPLICATION FACTOR RESET TO nnn.nn.
Issued By: CBMIND.
Reason: User has entered new value for standard error of estimate.
System Action: Value changed internally.
User Action: None.

CBM045I USER CHOOSES TO INPUT 2 INDEPENDENT VARIABLES.
Issued By: CBMIND.
Reason: User has depressed function key indicating decision to enter value for two independent variables.
System Action: None.
User Action: None.

CBM046A ANTHROPOMETRIC DIMENSION vbl name REFERENCED BY LINK link name DOES NOT EXIST IN MEMBER membername.
Issued By: CBMIN1.
Reason: One of the vital anthropometric dimensions needed to generate the link length in question does not exist in the referenced regression member.
System Action: Program end.
User Action: Print contents of referenced regression member (from Anthropometric Data Base); call systems programmer.

CBM047A ABNORMAL PROGRAM END.
Issued By: CBMIN1.
Reason: Key data vital to the construction of the man-model was not available.
System Action: Program end.
User Action: Contact systems programmer.

CBM050A NO VISIBILITY PLOT DATA AVAILABLE ON UNIT 9.
Issued By: CBMVIS.
Reason: Disk file referenced by FT09 DD card contained no coordinate data on the workspace boundary; visibility plot could not be generated.
System Action: Return to calling program.
User Action: Contact systems programmer.

CBM051I VISIBILITY PLOT GENERATED SUCCESSFULLY.
Issued By: CBMVIS.
Reason: Successful completion of visibility plot.
System Action: None.
User Action: None.

CBM052A END OF DATA ON UNIT 9.
Issued By: CBMVIS.
Reason: Insufficient data on Unit 9 to generate visibility plot.
System Action: Return to calling program.
User Action: Contact systems programmer.

SECTION 3

COMBIMAN ANTHROPOMETRIC DATA BASE MAINTENANCE PROGRAM (CBMAM)

As the man-model used in the COMBIMAN system has become more sophisticated, the user has often been asked to supply more data to be used in establishing dimensions for the model. To simplify this task for both the user and the computer, a data base or computer file was constructed to store key data items. This data base resides on a direct-access disk, and contains anthropometric and regression data relevant to the construction of the man-model.

Information on the data base is organized into groups of related records called members. Members may pertain to either regression data, or anthropometric survey data. Data for survey members will generally be subsets of existing anthropometric surveys in the AMRL Anthropometric Data Bank. To add a new member to the data base, the key information needed includes the mean and standard deviation for each anthropometric variable and a set of correlation coefficients among all the variables of the member. If the reader does not have this information available to him, he should skip this section and use the survey members which exist on the data base.

3.1 PROCESSING PERFORMED

The program CBMAM (COMBIMAN Anthropometric Data Base Maintenance Program) allows the user to create and maintain the Anthropometric Data Base. Input supplied by the user in 80 character computer card format, or in card image format (80 character records) on magnetic tape is read into the program CBMAM and processed according to the user's selection of control commands. These commands allow the user to add members to the data base, delete members from the data base, print or punch existing members onto computer cards, list the contents of the data base, or compress data together on the file, thus combining unused records together for

larger blocks of available storage. The data flow of the program is shown in Figure 28.

The data base is made up of two types of related data called members. One type consists of regression data which is used by the interactive graphics program CBM04 when predicting anthropometric surface dimensions needed to generate the link system of the man-model. The second type consists of survey data which define the means, standard deviations, and percentiles for each of the defined variables for a particular survey. Each group of data, whether dealing with regression or survey information, is called an anthropometric member, and is referenced by the member's name and type classification.

3.2 RESTRICTIONS AND LIMITATIONS

A maximum of 20 members (the total of the combination of regression and survey types) may be added to the Anthropometric Data Base. The number of records for each member is variable, but the sum of the record counts for all the members may not exceed 1979 records. Information on the number of members on the data base and their size may be obtained by using the +PRT control card. This will be explained in greater detail in Paragraph 3.3.2.9.

Additional limitations on number of variables and related data will be explained in Paragraph 3.3.2. Members to be added should have unique member names. If the new member name matches any name in the directory, the member will not be added.

3.3 HOW TO USE PROGRAM CBMAM

At the present time the key survey used in COMBIMAN is a subset of the 1967 Survey of the USAF Flying Personnel (Reference 3). As new surveys become available, or subsets of existing surveys in the AMRL Data Bank become needed, the program CBMAM will be used to add these new members. In most cases, each new survey type member will have a corresponding

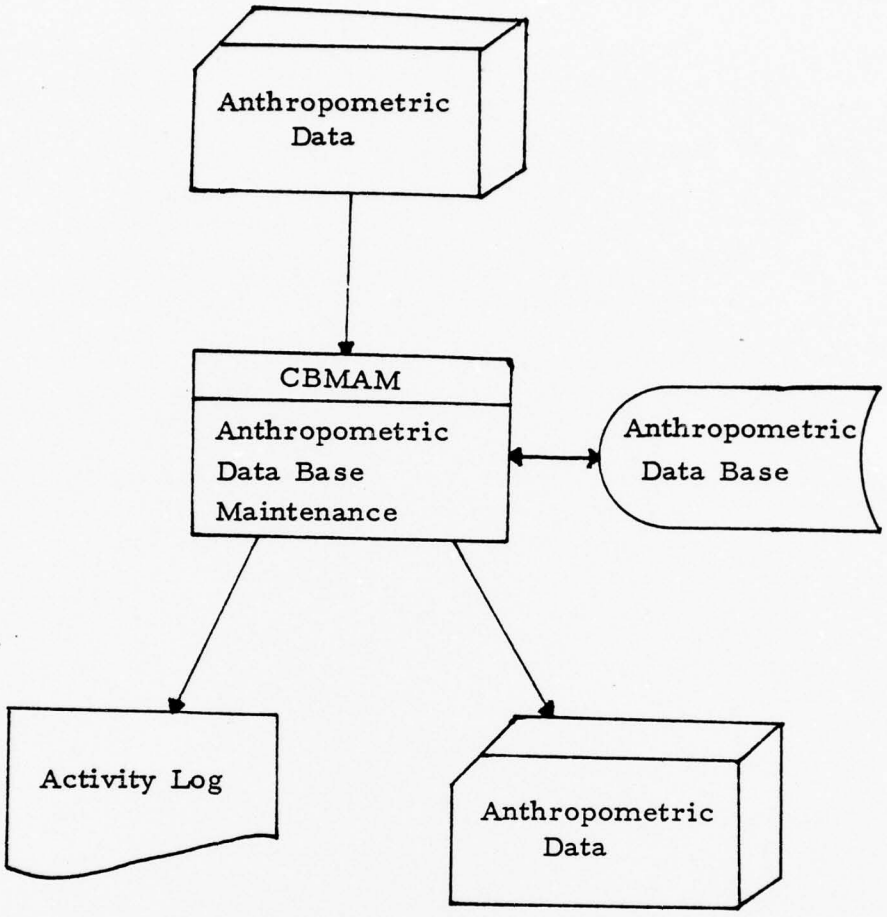

Figure 28. Data Flow for Program CBMAM.

regression type member which contains multiple and single regression equation coefficients used to predict additional anthropometric variables from those which the user has specified. In a few cases, one regression type member might be referenced by several survey type members. These are special cases, however, and this practice should not be used regularly without first consulting with personnel in the Crew Station Integration Branch of the 6570th Aerospace Medical Research Lab, Wright-Patterson Air Force Base, Ohio, to verify the statistical accuracy of the regression data with the anthropometric survey in question.

Since the 1967 USAF Flying Personnel Survey is the main survey used in COMBIMAN to date all examples illustrating the use of CBMAM will be based on this survey and its regression type counterpart.

3.3.1 Identifying Input Data

The nucleus of the anthropometric variables considered for input as part of any anthropometric member should be the 11 dimensions required to generate the 33 internal link lengths of the COMBIMAN man-model skeletal system. These variables are listed in Table 5. Few users of COMBIMAN will have specific values in mind to input for each of the 11 dimensions, however. To accommodate this, additional anthropometric variables can be selected which are found to be good predictors of either body segment mass or body segment length, and have moderately high correlations with the 11 required surface dimensions. The variables chosen to predict mass and length for the 1967 Survey are shown in the appropriate columns of Table 6. Those variables in Table 6 which are both predictors and required dimensions are marked with an asterisk.

When the user has only two specific values in mind he may select one variable from one column in Table 6 and the other from the other column in Table 6 and supply the values. The dimensions for the variables in Table 5 will be computed based on multiple regression equations stored on disk and available to the interactive graphics program CBM04.

TABLE 5

LIST OF DEPENDENT VARIABLES NEEDED TO GENERATE THE PRESENT COMBIMAN LINK SYSTEM

Sitting Height

Acromion Height, Sitting

Knee Height, Sitting

Buttock-Knee Length

Shoulder-Elbow Length

Biacromial Breadth

Hip Breadth

Chest Depth

Foot Length

Hand Length

Forearm-Hand Length

TABLE 6

LIST OF ANTHROPOMETRIC DIMENSIONS RELATED TO (A) BODY SEGMENT MASS AND (B) BODY SEGMENT LENGTH, RESPECTIVELY

(a)	(b)
Weight	*Sitting Height
Bideltoid Breadth	Eye Height, Sitting
Hip Breadth, Sitting	*Knee Height, Sitting
*Chest Depth	*Buttock-Knee Length
	Elbow-Grip Length
	Thumb-Tip Reach

*Variables marked are both (1) predictors of either body segment length or body segment mass and (2) required surface dimensions.

After analyzing the corelation coeefficients among the variables and the predicted dimension values in the 1967 Survey, it was decided that 17 variables formed by combining the 10 predictors or independent variables, and the 11 required anthropometric dimensions would be a sufficient basis for the anthropometric requirements of COMBIMAN.

Once the complete set of variables had been established, it is necessary to go to the AMRL Anthropometric Data Bank to obtain standard deviations, means, percentiles, and correlation coefficients for each variable of the particular survey. The set of variables used for the 1967 Survey is shown in Table 7. A sample of the data obtained for Weight is shown in Figure 29. All but one of the 17 variables selected in Table 7 were measured and contained in the 1967 Anthropometric Survey of Air Force Rated Officers. The method for obtaining mean, standard deviations, percentile, and correlation values for this seventeenth variable (forearm-hand length) used available values for elbow-wrist length and hand length.

The regression coefficients used in the multiple regression equations were based on means, standard deviations and correlation coefficients available for each variable, and on the equations which were developed in WADD-TR-60-31, pages 69-70 (see Reference 4). Tables 8 and 9 show the correlation coefficient matrices used in calculating the regression coefficients. The correlation coefficients were obtained from the 1967 Correlation Tape, #X00696, stored at the Computer Science Center, Bldg. 676, WPAFB. They are also available in report "The Aerospace Medical Research Laboratory Anthropometric Data Bank Library, Volumes I-V" (Reference 3).

The total number of multiple regression equations needed for a particular survey is calculated using the following equation:

$$NR = (NM \times NL) \times ND \qquad (1)$$

where NM is the number of variables related to body segment mass, NL is the number of variables related to body segment length, ND is the number of

TABLE 7

LIST OF ANTHROPOMETRIC DIMENSIONS PRESENTLY AVAILABLE IN THE ANTHROPOMETRIC DATA BASE

Weight

Sitting Height

Eye Height, Sitting

Acromion Height, Sitting

Knee Height, Sitting

Buttock-Knee Length

Shoulder-Elbow Length

Elbow-Grip Length

Thumb-Tip Reach

Biacromial Breadth

Bideltoid Breadth

Hip Breadth

Hip Breadth, Sitting

Chest Depth

Foot Length

Hand Length

Forearm-Hand Length

VARIABLE NAME: WEIGHT

MEAN: 173.60 LBS

STANDARD DEVIATION: 21.44 LBS

PERCENTILE DATA:

Percentile	1	2	3	5	10	15	20	25	30
Weight	127.58	132.63	135.82	140.15	146.89	151.53	155.27	158.56	161.56
Percentile	35	40	45	50	55	60	65	70	75
Weight	164.37	167.08	169.74	172.42	175.13	177.92	180.84	183.97	187.41
Percentile	80	85	90	95	97	98	99		
Weight	191.32	195.91	201.83	210.76	216.62	220.94	227.73		

Figure 29. Sample Data Obtained from Summary Statistics of 1967 Survey of the Air Force Rated Officers. (Reference 3)

TABLE 8

MATRIX OF CORRELATION COEFFICIENTS BETWEEN
MASS AND LENGTH RELATED VARIABLES (REFERENCE 3)

	Sitting Height	Eye Hgt, Sitting	Knee Hgt, Sitting	Butt-Knee Length	Elbow-Grip Length	Thumb-Tip Reach
Weight	.4568	.4119	.5386	.4544	.4085	.4138
Bidetoid Brdth.	.2782	.2598	.3398	.4379	.2514	.2784
Hip Brdth., Sitting	.3755	.3457	.4283	.5502	.3432	.3270
Chest Depth	.3333	.3078	.4084	.5479	.2882	.2965

TABLE 9

MATRIX OF CORRELATION COEFFICIENTS BETWEEN
DEPENDENT AND INDEPENDENT VARIABLES (REFERENCE 3)

DEPENDENT VARIABLES	INDEPENDENT VARIABLES									
	Weight	Sitting Hgt	Eye Hgt, (S)	Knee Hgt, (S)	Butt-Knee Length	Forearm-Grip Length	Thumb-Tip Reach	Bideltoid Brdth.	Hip Brdth. (S)	Chest Depth
Sitting Hgt	.4568	1.00	.9302	.5148	.3917	.4613	.4138	.2782	.3333	.1299
Acromion Hgt(S)	.4862	.8126	.7780	.4452	.3382	.3823	.3482	.2676	.3916	.2008
Knee Hgt(S)	.5386	.5148	.4876	1.	.7851	.7817	.7002	.3398	.4084	.2853
Buttock-Knee Length	.6363	.3917	.3897	.7851	1.	.6238	.6041	.4379	.5479	.4168
Shoulder-Elb. Length	.3995	.4573	.4584	.7500	.6967	.6743	.6752	.2515	.2997	.2092
Biacromial Breadth	.4516	.3491	.2964	.3745	.2954	.3481	.3235	.6571	.3202	.2681
Hip Breadth	.8094	.3755	.3457	.4283	.5502	.3432	.3270	.6225	.9031	.5803
Chest Depth	.7593	.1299	.1065	.2853	.4168	.2034	.2523	.6240	.6318	1.
Foot Length	.4711	.4786	.4497	.6919	.5957	.6517	.5545	.3067	.3498	.2445
Hand Length	.3889	.4506	.4155	.6539	.5432	.7070	.5757	.2553	.2578	.2005
Forearm-Hand Length	.4435	.4843	.4253	.8060	.6530	.9080	.7084	.2843	.3114	.2267

dependent variables, and NR is the total number of multiple regression equations needed. In the case of the 1967 Survey, each of the 24 combinations of mass-length-related dimensions has its own set of 11 multiple regression equations which compute the surface dimensions required in the generation of the man-model. In addition to multiple regression coefficients, simple regression coefficients and the associated standard error of estimate are available for each of the 24 combinations. The standard units of measurement for all variables and coefficients used in COMBIMAN at the present time are pounds and inches, but provisions exist to change these to metric units if needed.

3.3.2 Specifying the Processing Desired

The Anthropometric Data Base Maintenance program, CBMAM, allows the user to create and maintain the Anthropometric Data Base. The data base contains regression data which is used by the interactive graphics program CBM04 when predicting anthropometric surface dimenions needed to generate the link system of the man-model. It also contains survey data which define the means, standard deviations, and percentiles for each of the defined variables for a particular anthropometric survey. Each group of data, whether dealing with regression or survey information, is called an anthropometric member, and is referenced by the member's name and type classification.

The program CBMAM allows the user to maintain the data base by the addition, deletion, listing, etc., of the member types. A function or option of the program such as addition, deletion, etc., is requested by typing the request on a computer card, one request per card. The requests for these control cards are in the format shown in Figure 30. Input to the program consists of computer cards with desired control functions and new anthropometric member data typed on them.

AD-A038 323 DAYTON UNIV OHIO RESEARCH INST F/G 5/8
USER'S GUIDE FOR THE PROGRAMS OF COMBIMAN.(COMPUTERIZED BIOMECH--ETC(U)
NOV 76 S M EVANS F33615-75-C-5092
UNCLASSIFIED UDRI-TR-76-71 AMRL-TR-76-117 NL

2 OF 2
AD A038323

END
DATE FILMED
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+	opr		member name	type	nvbl.	ncmb	ndep	npct	regr name		Optional Sequence Number
9 1	9 9 9 2 3 4	9 5	9 9 9 9 9 9 9 9 6 7 8 9 10 11 12 13	9 9 9 9 14 15 16 17	9 9 9 9 18 19 20 21	9 9 9 9 22 23 24 25	9 9 9 9 26 27 28 29	9 9 9 9 30 31 32 33	9 9 9 9 9 9 9 9 34 35 36 37 38 39 40 41	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72	9 9 9 9 9 9 9 9 73 74 75 76 77 78 79 80

These control cards may be placed in any order in the input stream of the program, with one exception. If the data base is to be initialized for the first time, the +INT control card must be first. In each of the following subsections the control card format of the particular function is listed first. This is followed by text which explains each keyword. Additional data formats, if any, are then described for each function.

3.3.2.1 Add Anthropometric Member Function

+ADD membername type nvbl ncmb ndep npct regr-name (followed by member definition)

The ADD Anthropometric Member Function, as defined by the +ADD control card and the member definition cards which follow, adds to the Anthropometric Data Base specific data under the name membername. The membername is an alphanumeric character string, no longer than 16 characters. Since the Anthropometric Data Base can contain data pertaining to both regression coefficients and anthropometric survey dimensions, the type field is used to distinguish between the two types of members. A type value of 0 signals that the member which follows will contain regression information, while a type value of 1 signifies that the member will contain survey dimensional data. The type value, as well as all other integer values supplied on the control card, must be right-justified within its field. The nvbl field defines the total number of variables which will be described in member membername. The maximum number is 25. The ncmb field indicates the maximum number of combinations of independent mass and length variables. The maximum number is 50. The value of ncmb is obtained by multiplying the number of independent variables pertaining to body segment mass by the number of independent variables pertaining to body segment length. The number of anthropometric variables needed to determine the internal link lengths is supplied in field ndep. The maximum number is 15. The last two fields, npct and regr name are used only when the type field value is 1. Npct contains the number of percentile values which will be supplied for every one of the nvbl variables. The maximum value for npct is 30. The regrname

field references the type 0 membername which contains the appropriate regression information.

An example of an +ADD control card for a type 0 member in the 1967 Survey is outlined in Figure 31. The membername is REGRES01, and will contain a total of 17 variables, with 24 combinations of independent variables, and 11 dependent variables. An example of an +ADD control card for a type 1 member is outlined in Figure 32. The number of percentiles for each variable of member 67Survey is 25, and the referenced regression type member is REGRES01. Note that the values for nvbl, ncmb and ndep are identical to the type 0 member REGRES01, shown in Figure 31.

For type zero members in the data base, record formats like those in Figure 33a thru Figure 33c are used. Figure 34 is an example of a regression, or type 0 member. The outlined areas on the figure should help to clarify the description of the various record formats of the type 0 member. The format in Figure 33a is used to define anthropometric variables used in this regression member. Columns 1-2 contain a sequence number for the variable, right-justified in the field. Columns 4-19 contain the 16-character name of the anthropometric variable. Columns 21-22 contain a two-character abbreviation for the default unit of measurement of the variable. Approved abbreviations are IN, CM, MM, LB, and KG pertaining to inches, centimeters, millimeters, pounds and kilograms, respectively. A "1" is punched in column 26, 30 or 34, depending on whether the variable is an independent variable pertaining to mass or length, or is a dependent variable necessary to generate the link lengths. A variable can be both independent and dependent, as in the case of sitting height, but it cannot pertain to both mass and length. If all three fields are blank, the card is flagged as containing an error. As each variable definition card is read in, the program analyzes the use of the variable and notes the variable's status in appropriate arrays.

```
+ADD REGRESO1    0   17   24   11
  1 WEIGHT              LB    1
  2 SITTING HEIGHT      IN         1    1
  3 EYE HGT/SITTING     IN         1
  4 ACROMION HGT/SIT    IN              1
  5 KNEE HGT/SITTING    IN         1    1
  6 BUTTOCK-KNE LGTH    IN         1    1
  7 SHOULDR-ELB LGTH    IN              1
  8 ELBOW-GRIP LGTH     IN         1
  9 THUMB-TIP REACH     IN         1
 10 BIACROMIAL BRDTH    IN              1
 11 BIDELTIOD BRDTH     IN    1
 12 HIP BREADTH         IN              1
 13 HIP BREADTH/SITT    IN    1
```

Figure 31. Example of +ADD Control Card for Type 0 Member.


```
+ADD 67SURVEY    1   17   24   11   25   REGRESO1
  1 2 3 5101520253035404550556065707580859095979899
  1 WEIGHT              LB 173.60686 21.434704127581326313582140151468915153
1552715856161561643716708169741724217513177921808418397187411913219591
2018321076216622209422773
  2 SITTING HEIGHT    IN 36.685932 1.2501624 3394 3424 3444 3470 3511 3539
  3562 3582 3600 3617 3633 3649 3665 3681 3698 3715 3733 3753 3775 3801
  3833 3880 3910 3931 3962
  3 EYE HGT/SITTING   IN 31.869176 1.1871142 2917 2950 2971 2998 3038 3065
  3087 3106 3123 3138 3153 3168 3183 3198 3213 3229 3246 3265 3286 3311
  3343 3390 3421 3443 3478
  4 ACROMION HGT/SIT IN 24.03821  1.123410  2142 2177 2197 2224 2263 2289
  2310 2327 2343 2358 2373 2387 2401 2415 2430 2445 2461 2479 2499 2522
  2551 2594 2620 2639 2666
```

Figure 32. Example of +ADD Control Card for Type 1 Member.

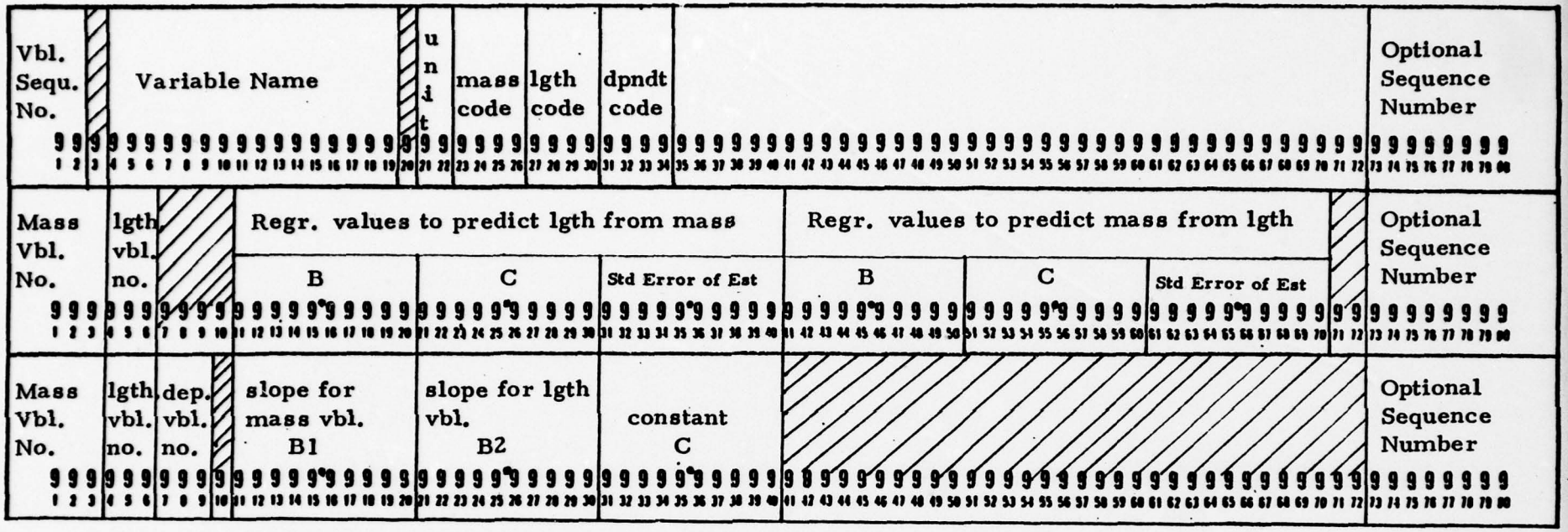

Figure 33.

(a) Program CBMAM Regression Member Variable Definition Card.

(b) Program CBMAM Regression Member Simple Regression Coefficient Definition Card.

(c) Program CBMAM Regression Member Multiple Regression Coefficient Definition Card.

```
+ADD REGRESO1    0  17  24  11
 1 WEIGHT                LB   1
 2 SITTING HEIGHT        IN        1    1                                        (1)
 3 EYE HGT/SITTING       IN        1
 4 ACROMION HGT/SIT      IN             1
 5 KNEE HGT/SITTING      IN        1    1
 6 BUTTOCK-KNE LGTH      IN        1    1
 7 SHOULDR-ELB LGTH      IN             1
 8 ELBOW-GRIP LGTH       IN        1
 9 THUMB-TIP REACH       IN        1
10 BIACROMIAL BRDTH      IN             1
11 BIDELTIOD BRDTH       IN   1
12 HIP BREADTH           IN             1
13 HIP BREADTH/SITT      IN   1
14 CHEST DEPTH           IN   1         1
15 FOOT LENGTH           IN             1
16 HAND LENGTH           IN             1
17 FORARM-HAND LGTH      IN             1
 1  2        0.02669   32.05275   1.11161   7.84538-114.20831  19.05910          (2)
 1  2  2  0.0         1.0000000  0.0
 1  2  4  0.0076260   0.6716000  -1.92387
 1  2  5  0.0175512   0.2668000   9.12241                                        (3)
 1  2  6  0.0286654   0.1086000  14.82459
 1  2  7  0.0075787   0.1875000   5.95968
 1  2 10  0.0131732   0.1105000   9.69417
 1  2 12  0.0279173   0.0043000   8.87957
 1  2 14  0.0313031  -0.1665000  10.32958
 1  2 15  0.0069724   0.1248000   4.85468
 1  2 16  0.0034882   0.0892000   3.64523
 1  2 17  0.0105057   0.2284818   9.12586
 1  3        0.02287   27.89858   1.08116   7.45657 -64.02781  19.52158
 1  3  2  0.0051654   0.9405000   5.81652
```

Figure 34. Example of Regression, or Type 0, Member.

The first outlined area of Figure 34 is an example of a Variable Definition Card. Looking back at Tables 5 and 6, one can see the variable Sitting Height appearing in both the list of independent variables, related to body segment length, and the list of dependent variables. For this reason, a "1" has been punched in column 30 and column 34.

For each combination of mass and length related independent variables, two types of record formats are used. The first, shown in Figure 33b, contains the variable numbers of mass and length variables used in this combination and simple regression information. The variable numbers, punched in columns 1-3 and 4-6 are obtained in columns 1-2 of the variable definition cares (Figure 33a). Columns 11-40 contain simple single regression information necessary to predict the length variable from the mass variable. This information includes the slope and constant in the regression formula:

$$Y = (B \times X) + C \qquad (2)$$

where:

B is the slope; and

C is the constant.

It also contains the standard error of estimate associated with the equation. Columns 41-70 contain similar data to predict mass from the length variable.

The regression data required for this card were obtained from unpublished data provided by the USAF. This report contained the slope, constant and standard error in metric units. The required coefficients were multiplied by appropriate factors to convert these to the English units specified on the Variable Definition Card. The final regression equation to predict sitting height in inches from weight in pounds would be:

Estimated Sitting Height = 0.02669 × Actual Weight + 32.05275
(Variable #2) (Variable #1)

The standard error would be 1.11161.

The equation to predict weight in pounds from sitting height in inches would be:

Estimated Weight = 7.84538 × Actual Sitting Height - 114.20831

The standard error would be 19.05910.

The second outlined area of Figure 34 shows the above coefficients punched on a simple regression coefficient card. The "1" in column 3 identifies Weight as the mass related variable, and the "2" in column 6 identifies Sitting Height as the length related variable. The period in the regression coefficient and standard error fields indicate the default location of the decimal point for these real values.

The second record type is shown in Figure 33c and defines the multiple regression information necessary to predict each dependent variable from the particular combination of mass and length variables. Columns 1-3 define the independent mass variable number; columns 4-6 define the length variable number; and columns 7-9 define the dependent variable number. Each integer value must be right-justified. Columns 11-20 define the slope associated with the mass variable value (B1); columns 21-30 define the slope for the length variable value (B2); and columns 31-40 define the constant of the equation (C). The equation form is:

$$Z = (B1 \times X) + (B2 \times Y) + C \qquad (3)$$

where:

X is the mass variable value;
Y is the length variable value; and
Z is the predicted dependent value.

The data for this card were derived from the correlation matrices shown in Tables 8 and 9, and from the equations in Reference 4. As an example, the multiple regression equation to predict Knee Height/Sitting from Weight and Sitting Height would be as follows:

Knee Height/Sitting = 0.0175512 × Weight + 0.2668000 × Sitting Height + 9.12241
(Variable #5) (Variable #1) (Variable #2)

The third outlined area of Figure 34 shows how this example would be punched. A "1" in column 3 identifies Weight as the mass variable; a "2" in column 6 identifies Sitting Height as the length variable; and a "5" in column 9 identifies Knee Height/Sitting as the dependent variable. The regression coefficients follow on the card.

If the number of data cards of the preceding format does not equal (ncmb x ndep) an error message is printed and the member is not added to the data base.

For type 1 records in the data base, record formats are like those shown in Figures 35a and 35b. The format in Figure 35a is used once per type 1 member, and defines the percentile names for which values will be supplied in succeeding cards.

Figure 29 shows the sample data obtained for the variable Weight. A total of 25 percentile values were available in the Summary Statistics. These include the 1st, 2nd, 3rd, 5th, 10th, thru the 95th, 97th, 98th and 99th. The 25 percentiles for which values will be given when adding the 67 Survey to the Anthropometric Data Base are shown in the first outlined area of Figure 36. Each percentile is punched in a two-digit integer field, right-justified within the area. The number of percentiles supplied must equal the value of the npct field of the +ADD (type 1) control card, or an error will be printed and the member will not be added. The maximum number of percentiles allowed is 30.

Figure 35b shows the format used in assigning dimensional values to the various variables. The integer variable number is in columns 1-2, while columns 4-19 contain the 16-character variable name. Columns 21-22 contain the two character abbreviation for the default unit of measurement. At the present time the default or standard unit for weight is

IBM

INTERNATIONAL BUSINESS MACHINES CORPORATION

MULTIPLE-CARD LAYOUT FORM

Form X21-6597-0
Printed in U.S.A.

Company ____________

Application ____________ by ____________ Date ________ Job No. ________ Sheet No. ________

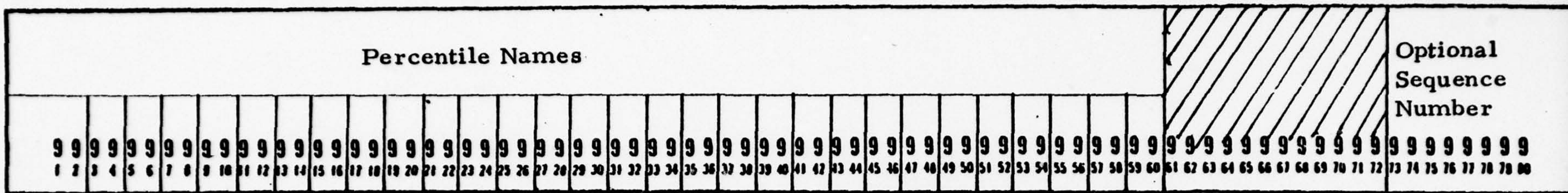

Figure 35a. Program CBMAM Survey Member Percentile Definition Card.

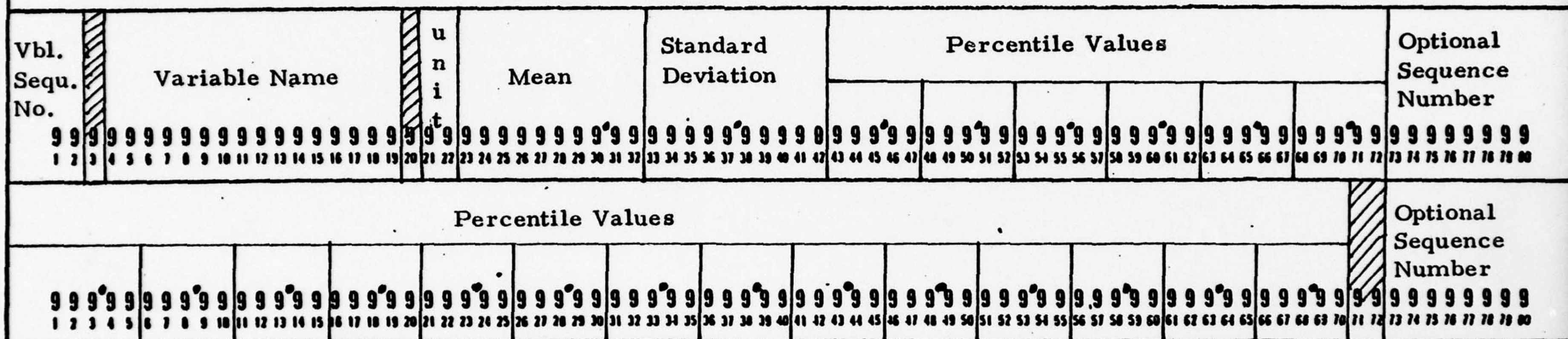

Figure 35b. Program CBMAM Survey Member Dimension Definition Cards.

```
+ADD 67SURVEY    1  17  24  11  25  REGRESO1
 1 2 3 5101520253035404550556065707580859095979899                    (1)
 1 WEIGHT              LB 173.60686 21.434704127581326313582140151468915153
155271585616156164371670816974172421751317792180841839718741191321959 1   (2)
20183210762166222094227 73
 2 SITTING HEIGHT    IN 36.685932 1.2501624 3394 3424 3444 3470 3511 3539
 3562 3582 3600 3617 3633 3649 3665 3681 3698 3715 3733 3753 3775 3801
 3833 3880 3910 3931 3962
 3 EYE HGT/SITTING   IN 31.869176 1.1871142 2917 2950 2971 2998 3038 3065
 3087 3106 3123 3138 3153 3168 3183 3198 3213 3229 3246 3265 3286 3311
 3343 3390 3421 3443 3478
 4 ACROMION HGT/SIT IN 24.03821  1.123410  2142 2177 2197 2224 2263 2289
 2310 2327 2343 2358 2373 2387 2401 2415 2430 2445 2461 2479 2499 2522
 2551 2594 2620 2639 2666
```

Figure 36. Example of Survey, or Type 1, Member.

pounds, and the standard unit for all other measurements is inches. For each variable number, the variable name and unit of measurement must correspond exactly with the same fields in the referenced type 0 or regression member. Columns 23-32 contain the overall mean for the named variable, in the default unit of measurement. Columns 33-42 contain the standard deviation. Columns 43-72 and 1-70 of as many additional cards as necessary contain the values for each of the percentiles named. If the number of percentile values does not correspond to the value of npct, an error condition occurs and the member is not added to the data base. The period in the fields in Figures 35a and 35b indicate the standard or default location of the decimal point in the real numbers.

The dimension data needed in this card were also obtained in the Summary Statistics of the 1967 Survey (Reference 3). A sample of this data for Weight is shown in Figure 29. The mean value of Weight, 173.60686 lbs, the standard deviation of 21.434704, and the weight associated with the first six percentiles (1st, 2nd, 3rd, 5th, 10th, 15th) are punched on the first card shown in the second outlined area of Figure 36. The weight values for the 20th thru the 85th percentiles are shown in the second card, while the remaining five percentiles, 90th thru 99th, are shown in the last card. Because the type 1 member references a type 0 member, it is essential that the type 0 member be entered into the data base prior to adding a type 1 member.

3.3.2.2 Check Anthropometric Member Function

+CHK membername type nvbl ncmb ndep npct regr name

The Check Anthropometric Member function operates in the same fashion as the Add Anthropometric Member function does, except the member is not added. The member is only checked for errors.

3.3.2.3 Delete Anthropometric Member Function

+DEL membername type

The Delete Anthropometric Member function removes the specified member from the data base, but does not make the space the member occupied available for reuse. The +CMP function must be used to accomplish this.

3.3.2.4 Compress Anthropometric Data Base Function

+CMP

The Compress Anthropometric Data Base function makes space available for storing anthropometric members, by shoving used space together and therefore maximizing the amount of continuous unused space. The intermediate blocks of unused space were created by the Delete Anthropometric Member function. The greater the activity of the Anthropometric Data Base (i.e., +ADD's and +DEL's), the more often it becomes necessary to use this +CMP function. Should the message "CBM310A INSUFFICIENT SPACE REMAINING TO ADD MEMBER membername" appear when you are trying to add a member, it would be necessary to use the +CMP function. Should the +CMP function be followed by the +ADD function which gives the CBM310A message, the data base is full and no new members can be added until an existing member is deleted.

3.3.2.5 Dump Anthropometric Member Function

+DMP membername type

+DMP

The Dump Anthropometric Member function displays on the printer the contents of the anthropometric member membername of type specified, or displays the complete Anthropometric Data Base if no member name is given on the control card. This function is used primarily by system programmers when testing the contents of the file.

3.3.2.6 End Program Function

+END

The End Program function control card terminates execution of the program CBMAM and returns control to the operating system.

3.3.2.7 Initialize Anthropometric Data Base Function

+INT

The Initialize Anthropometric Data Base function will reset the data base to its original unused state. Any members that were on the data base before the function was invoked will be purged and all the space will be available for new members. The primary purpose of this function is to establish a data base.

3.3.2.8 Punch Anthropometric Member Function

+PCH membername type

The Punch Anthropometric Member function will punch a copy of the specified member in a format that the Add Anthropometric Member function requires for the specified type. The member is punched onto computer cards. Specifying a member name that does not exist causes a printout of the member names that are on the data base. This function does not remove the member from the data base.

3.3.2.9 Print Anthropometric Member Function

+PRT membername type

+PRT

The Print Anthropometric Member function will print the contents of the specified member, membername, of type type, in a format similar to that used in the Add Anthropometric Member function. Specifying no name, or a name that is not in the data base causes a printout of the index which contains names of members in the data base, the record numbers the members occupy in the data base, the type, and any additional data as supplied on the +ADD control card when the members were added to the data base.

3.3.3 Submitting a Processing Request

In submitting a processing request for the program CBMAM, the user must use a predetermined set of Job Control Cards (JCL) which call the program CBMAM and define the files used (such as the data base itself). Located within this deck of JCL cards will be the program function control cards and any related member definition cards. The set of JCL used is shown in Figure 37. Use of the card which begins //FT02F001 as shown in Figure 37 assumes that the space on disk for the data base has already been allocated. If for some reason this condition is not met, the //FT02F001 DD card in Figure 37 should be replaced by the card sequence shown in Figure 38. The JCL deck should be run with this replacement series only once - enough to allocate the space for the file on disk, and to catalogue the file in the system library. Thereafter the simplified "//FT02F001 DD" card shown in Figure 37 should be used.

If the file has just been created, or if the user wishes to re-initialize the file, the +INT control function should be used before any other control card function.

Any members to be added or checked should follow the +INT card, if used. Since the type 1 survey members use the data available in the referenced type 0 regression member, it is essential that the referenced type 0 member already exist on the Anthropometric Data Base.

The last control card read into the program should be the +END control card.

3.3.4 Interpreting the Output Data Received

The program CBMAM generates output to the card punch, to the disk file, or to the printer depending on the control card function specified. The formats for the printed output will be discussed in this section. Punched records use the same format as the input data records discussed in Paragraph 3.3.2, and will not be described here. The format for the records on

```
//CBMAM    JOB   (UDR807,JC),EVANS,MSGLEVEL=(1,1)          RUN DECK
//JOBLIB   DD    DSN=COMBIMAN.LINKLIB,DISP=SHR
//GO       EXEC  PGM=CBMAM
//FT02F001 DD  DSN=COMBIMAN.ANTHDATA,DISP=OLD
//FT05F001 DD  DDNAME=SYSIN
//FT06F001 DD  SYSOUT=A
//FT07F001 DD  SYSOUT=B
//SYSIN    DD  *


        CBMAM FUNCTION CONTROL CARDS AND
         MEMBER DEFINITION DATA GO HERE


/*
//
```

Figure 37. Job Control Cards for Program CBMAM.

```
//FT02F001 DD  DSN=COMBIMAN.ANTHDATA,DISP=(NEW,CATLG),UNIT=SYSDA,
//             VOL=SER=PUBLIC,SPACE=(248,2000),
//             DCB=(BLKSIZE=248,LRECL=248,RECFM=F)
```

Figure 38. FT02 DD Card to Allocate Space on Disk.

the data base should be of no concern to the normal user, and will therefore not be described here. If the user needs to know the format for the records on the data base, he should contact the systems programmer.

Five basic types of formats are used by CBMAM when outputting data to the printer. Each of these format types, their use, and an example of each will be presented in the following paragraphs. Each of the types begin with the same heading, listing the source program (in this case, CBMAM), the date and the time of the program execution, and a page number.

The first type of output is generated by the Initialize, Punch, Compress, Delete, and End functions. The nature of these functions does not necessitate a large amount of printed output to be supplied to the user. The output informs the user of the start and end of processing associated with the function specified. For the Compress function, additional messages are supplied, telling the user that a particular member was or was not moved in the process of combining unused records. An example of this format for the Compress function is shown in Figure 39.

The second type of output is generated by the Print or Punch functions when the +PRT or +PCH control cards are supplied with a blank membername field. This causes a listing of the index of the data base. The location and type of each member is contained on the index as one record. This information is printed to the user in the following format:

nn.) membername, EXTENT = (n1, n2), TYPE = tt,
nv variables, nc COMB OF INDEP, nd DEPENDENT,
np PERCENTILES, r-membername REFERENCED SURVEY.

where:
- nn is the record number of this identification record within the directory.
- n1 is the location within the data base of the first record of data which defines this member
- n2 is the location of the last record of data which defines this member

```
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CBM3001 +CMP
CBM3341 REGRESO1 NOW IN PLACE.
CBM3341 67SURVEY NOW IN PLACE.
CBM3361 COMPRESS FINISHED.
```

Figure 39. Example of Program CBMAM +CMP Function Output.

tt is the type code (0 or 1)

nv is the total number of anthropometric variables defined

nc is the number of combinations of independent variables

nd is the number of dependent variables

np is the number of percentiles (np = 0 if tt = 0)

r-membername is the name of the referenced regression member (r-membername is blank if tt = 0).

This information was originally supplied to the data base on the +ADD control card. An example of this use of the PRINT function is shown in Figure 40.

The third type of output is generated by the Dump function. This function should be used primarily by systems programmers to aid in locating the cause of I/O (Input/Output) errors on the data base. For the member specified on the +DMP Control Card, a message giving directory or index information is printed, using the output format previously described for the +PRT control card. Each data record associated with the member is then printed in the following format:

RECORD nnn + = + (record in EBCDIC) + = +
+ = + (record in hexadecimal) + = +
+ = + (remainder of record in hexadecimal) + = +

where nnn is the location within the data base of the record. The record in EBCDIC is printed using a 25A4 format. The record in hexadecimal is printed using a 10Z8 format. An example of the Dump function is shown in Figure 41.

The fourth output format is used by the Check, Add and Print functions when a type 0, or regression member is specified. After reading the control card and checking it for errors, the information contained on the control card is reformatted and written out to the printer.

```
CBMAM --- ANTHROPOMETRIC SURVEY DATA BASE MAINTENANCE PROGRAM                10/21/76  14. 9.56  PAGE  11

CBM300I *PRT              0
          20.1 67SURVEY, EXTENT=(  63,  801, TYPE= 1, 17 VARIABLES, 24 COMB OF INDEP, 11 DEPENDENT, 25 PERCENTILES,
                         REGRESO1 REFERENCED SURVEY.
          21.1 REGRESO1, EXTENT=(  22,  621, TYPE= 0, 17 VARIABLES, 24 COMB OF INDEP, 11 DEPENDENT,  0 PERCENTILES,
                                   REFERENCED SURVEY.
```

Figure 40. Example of Program CBMAM +PRT Function Output.

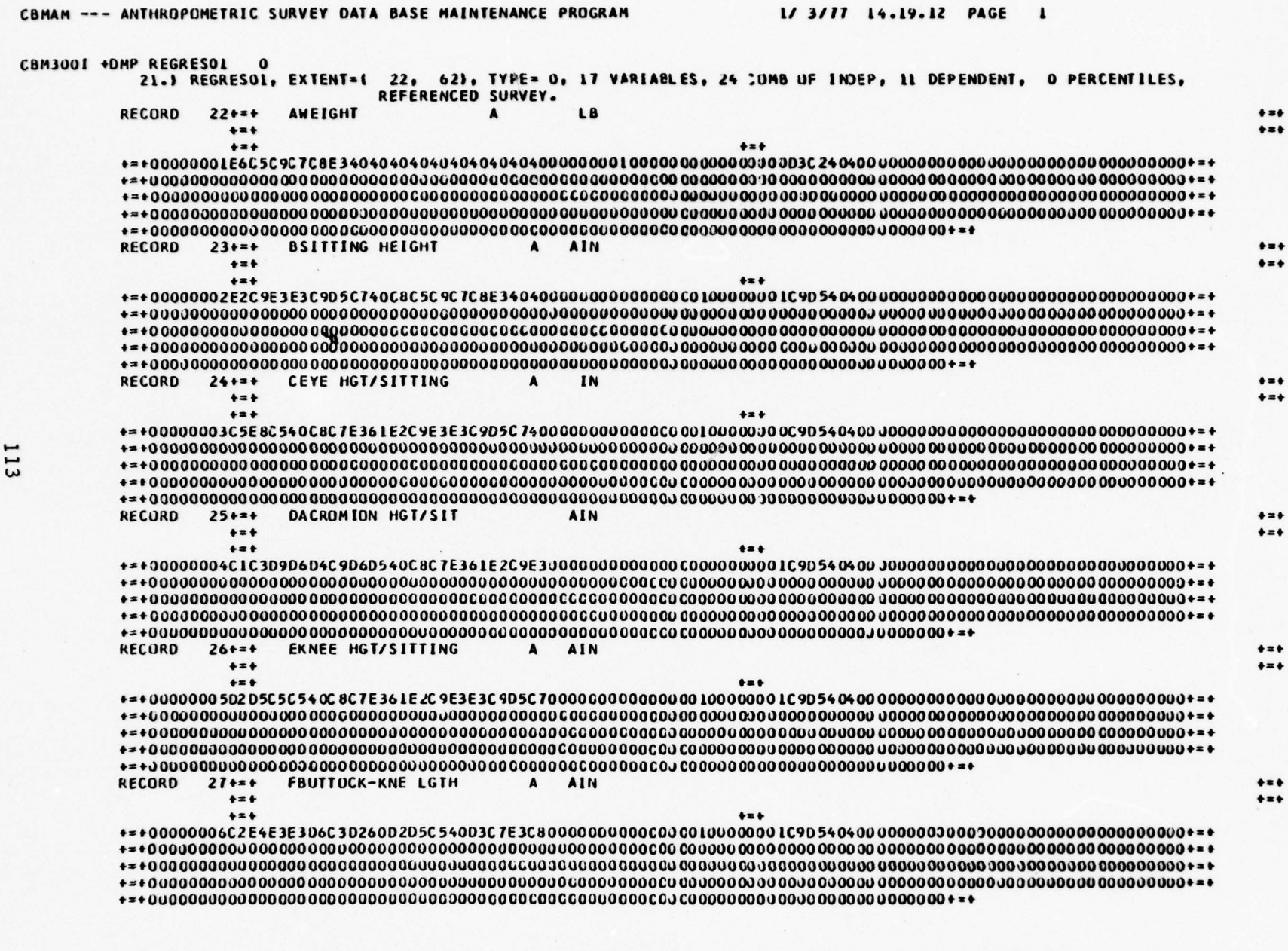


Figure 41. Example of Program CBMAM +DMP Function Output.

Following the control card information, each variable definition card is printed. The format used for printing the variable definition card is as follows:

nn.) variable name, INDEP VBLS (MASS = n1, LENGTH = n2),
DEP VBL = n3, UNIT OF MEASUREMENT = uu

where nn is the variable number

variable name is the 16 character name of the variable

n1 is either 0 or 1, where 1 indicates that the variable is an independent variable pertaining to mass, and 0 means it is not

n2 is either 0 or 1, where 1 indicates that the variable is an independent variable pertaining to length, and 0 means it is not

n3 is either 0 or 1, where 1 indicates that the variable is a dependent variable, and 0 means it is not

uu is the unit of measurement assigned to the variable: either IN, CM, MM, LB, or KG.

After the variable definition data, the regression data for each combination of independent variables is printed. The format is shown in Figure 42. The terms are defined as follows:

n1	is the variable number for the mass-related variable
mass name	is the variable name for the mass-related variable
n2	is the variable number for the length-related variable
length name	is the variable name forthe length-related variable
$bb.bbb_1$	is the slope used to predict length variable from mass variable
$cc.ccc_1$	is the constant used to predict length variable from mass variable
$ss.sss_2$	is the standard error of the estimate of the equation
$nd_1 - nd_{ndep}$	are the variable numbers for the dependent variables

INDEPENDENT VARIABLES (MASS & LENGTH)	DEPENDENT VARIABLE	REGRESSION COEFFICIENTS (B1, B2, CNST)
n1 mass name n2 length name	SIMPLE REGR (B1, CNST, SE) -	LENGTH FROM MASS bb.bbb$_1$ cc.ccc$_1$ ss.sss$_1$
		MASS FROM LENGTH bb.bbb$_2$ cc.ccc$_2$ ss.sss$_2$
nd$_1$	dep vbl name$_1$	bb.bbbbb$^1_1$ bb.bbbbb$^2_1$ cc.ccccc$_1$
⋮	⋮	⋮ ⋮ ⋮
nd$_{ndep}$	dep vbl name$_{ndep}$	bb.bbbbb$^1_{ndep}$ bb.bbbbb$^2_{ndep}$ cc.ccccc$_{ndep}$

Figure 42. Output Format Used for Type 0 Regression Data.

$depname_1$ - $depname_{ndep}$	are the variable names for the dependent variables
$bb.bbbbb^1_1$ - $bb.bbbbb^1_{ndep}$	is the slope for the mass variable when predicting dependent $variable_i$, where i = 1, ndep
$cc.ccccc_1$ - $cc.ccccc_{ndep}$	is the constant for the multiple regression equation to predict dependent $variable_i$, where i = 1, ndep.

An example of the fourth format for the +ADD control card is shown in Figure 43a to 43g.

The fifth output format is also used by the Check, Add and Print functions, but only when the type code is 1, signifying a survey member. After reading the control card and checking it for errors, the information on the card relevant to the number of records written to the data base is reformatted and written to the printer.

Following the control card information, the percentile names (such as 1, 2, 3, 50, 95, etc.) for the member are printed as part of a sub-heading. A maximum of 10 percentile names are printed on one line. The survey data is then printed using the following format:

$$\underline{nn.)}\ \underline{\text{variable name}}\ \underline{uu}\ \underline{mmm.mm}\ \underline{ss.sss}\ \underline{ppp.pp}_1 \cdots \underline{ppp.pp}_{10}$$
$$\underline{ppp.pp}_{11} \cdots \underline{ppp.pp}_{20}$$
$$\underline{ppp.pp}_{21} \cdots \underline{ppp.pp}_{npct}$$

where:		
	nn	is the variable number
	variable name	is the name of the anthropometric variable
	uu	is the specified unit of measurement for the variable
	mmm.mm	is the calculated mean value for the variable
	ss.sss	is the calculated standard deviation for the variable

```
CBMAM --- ANTHROPOMETRIC SURVEY DATA BASE MAINTENANCE PROGRAM          10/21/76  14. 9.56  PAGE   1

CBM300I +ADD REGRESO1   0  17  24  11   0
CBM313I MEMBER REGRESO1 IS TYPE 0 AND CONTAINS 17 ANTHROPOMETRIC VARIABLE NAMES.
CBM314I MEMBER ALSO CONTAINS 24 ADDITIONAL RECORDS, EACH CONTAINING THE REGRESSION COEFFICIENTS FOR 11 DEPENDENT VARIABLES.
        1.) WEIGHT          , INDEP VBLS(MASS= 1, LENGTH= 0), DEP VBL= 0, UNIT OF MEASUREMENT= LB
        2.) SITTING HEIGHT  , INDEP VBLS(MASS= 0, LENGTH= 1), DEP VBL= 1, UNIT OF MEASUREMENT= IN
        3.) EYE HGT/SITTING , INDEP VBLS(MASS= 0, LENGTH= 1), DEP VBL= 0, UNIT OF MEASUREMENT= IN
        4.) ACROMION HGT/SIT, INDEP VBLS(MASS= 0, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN
        5.) KNEE HGT/SITTING, INDEP VBLS(MASS= 0, LENGTH= 1), DEP VBL= 1, UNIT OF MEASUREMENT= IN
        6.) BUTTOCK-KNE LGTH, INDEP VBLS(MASS= 0, LENGTH= 1), DEP VBL= 1, UNIT OF MEASUREMENT= IN
        7.) SHOULDR-ELB LGTH, INDEP VBLS(MASS= 0, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN
        8.) ELBOW-GRIP LGTH , INDEP VBLS(MASS= 0, LENGTH= 1), DEP VBL= 0, UNIT OF MEASUREMENT= IN
        9.) THUMB-TIP REACH , INDEP VBLS(MASS= 0, LENGTH= 1), DEP VBL= 0, UNIT OF MEASUREMENT= IN
       10.) BIACROMIAL BRDTH, INDEP VBLS(MASS= 0, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN
       11.) BIDELTIOD BRDTH , INDEP VBLS(MASS= 1, LENGTH= 0), DEP VBL= 0, UNIT OF MEASUREMENT= IN
       12.) HIP BREADTH     , INDEP VBLS(MASS= 0, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN
       13.) HIP BREADTH/SITT, INDEP VBLS(MASS= 1, LENGTH= 0), DEP VBL= 0, UNIT OF MEASUREMENT= IN
       14.) CHEST DEPTH     , INDEP VBLS(MASS= 1, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN
       15.) FOOT LENGTH     , INDEP VBLS(MASS= 0, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN
       16.) HAND LENGTH     , INDEP VBLS(MASS= 0, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN
       17.) FORARM-HAND LGTH, INDEP VBLS(MASS= 0, LENGTH= 0), DEP VBL= 1, UNIT OF MEASUREMENT= IN

 INDEPENDENT VARIABLES (MASS & LENGTH)     DEPENDENT VARIABLE     REGRESSION COEFFICIENTS (B1, B2, CNST)

  1 WEIGHT              2 SITTING HEIGHT   SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS      0.027  32.053    1.112
                                                                      MASS        LENGTH    7.845-114.208   19.059
                                             2 SITTING HEIGHT     0.0         1.00000   0.0
                                             4 ACROMION HGT/SIT   0.00763     0.67160  -1.92387
                                             5 KNEE HGT/SITTING   0.01755     0.26680   9.12241
                                             6 BUTTOCK-KNE LGTH   0.02867     0.10860  14.82459
                                             7 SHOULDR-ELB LGTH   0.00758     0.18750   5.95968
                                            10 BIACROMIAL BRDTH   0.01317     0.11050   9.69417
                                            12 HIP BREADTH        0.02792     0.00430   8.87957
                                            14 CHEST DEPTH        0.03130    -0.16650  10.32958
                                            15 FOOT LENGTH        0.00697     0.12480   4.85468
                                            16 HAND LENGTH        0.00349     0.08920   3.64523
                                            17 FORARM-HAND LGTH   0.01051     0.22848   9.12586
  1 WEIGHT              3 EYE HGT/SITTING  SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS      0.023  27.899    1.081
                                                                      MASS        LENGTH    7.457 -64.028   19.522
                                             2 SITTING HEIGHT     0.00517     0.94050   5.81652
                                             4 ACROMION HGT/SIT   0.01047     0.65900   1.21862
                                             5 KNEE HGT/SITTING   0.01862     0.26460  10.29247
                                             6 BUTTOCK-KNE LGTH   0.02842     0.13760  14.46654
                                             7 SHOULDR-ELB LGTH   0.00798     0.20110   6.35904
                                            10 BIACROMIAL BRDTH   0.01416     0.08570  10.84526
                                            12 HIP BREADTH        0.02782     0.00930   8.75802
                                            14 CHEST DEPTH        0.03049    -0.15870   9.41976
                                            15 FOOT LENGTH        0.00752     0.12150   5.46532
                                            16 HAND LENGTH        0.00395     0.08370   4.16954
                                            17 FORARM-HAND LGTH   0.01209     0.19732  10.94443
```

Figure 43a. Example of Program CBMAM +ADD Function Output for Type 0 Member.

INDEPENDENT VARIABLES (MASS & LENGTH)	DEPENDENT VARIABLE	REGRESSION COEFFICIENTS (B1, B2, CNST)					
1 WEIGHT	5 KNEE HGT/SITTING	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.025	17.666	0.827
		MASS		LENGTH	11.762	-84.611	18.054
	2 SITTING HEIGHT	0.01474	0.48200	23.54442			
	4 ACROMION HGT/SIT	0.01821	0.29590	14.37994			
	5 KNEE HGT/SITTING	0.0	1.00000	0.0			
	6 BUTTOCK-KNE LGTH	0.01491	0.67510	6.37341			
	7 SHOULDR-ELB LGTH	-0.00020	0.51800	2.81440			
	10 BIACROMIAL BRDTH	0.01256	0.14420	10.68774			
	12 HIP BREADTH	0.02823	-0.00810	9.16118			
	14 CHEST DEPTH	0.03049	-0.13470	7.37230			
	15 FOOT LENGTH	0.00303	0.29470	3.64651			
	16 HAND LENGTH	0.00078	0.20610	2.86251			
	17 FORARM-HAND LGTH	0.00048	0.65291	4.91520			
1 WEIGHT	6 BUTTOCK-KNE LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.032	18.299	0.821
		MASS		LENGTH	12.813	-131.085	16.540
	2 SITTING HEIGHT	0.02053	0.19950	28.41289			
	4 ACROMION HGT/SIT	0.02369	0.05110	18.67545			
	5 KNEE HGT/SITTING	0.00300	0.68630	5.11351			
	6 BUTTOCK-KNE LGTH	0.0	1.00000	0.0			
	7 SHOULDR-ELB LGTH	-0.00232	0.47190	3.33250			
	10 BIACROMIAL BRDTH	0.01581	0.00970	13.06010			
	12 HIP BREADTH	0.02673	0.04120	8.20378			
	14 CHEST DEPTH	0.02958	-0.07950	6.44568			
	15 FOOT LENGTH	0.00358	0.21920	4.84350			
	16 HAND LENGTH	0.00109	0.15100	3.74169			
	17 FORARM-HAND LGTH	0.00177	0.46986	7.85146			
1 WEIGHT	8 ELBOW-GRIP LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.012	11.755	0.581
		MASS		LENGTH	13.732	-16.719	19.569
	2 SITTING HEIGHT	0.01877	0.64760	24.45119			
	4 ACROMION HGT/SIT	0.02078	0.38970	15.02894			
	5 KNEE HGT/SITTING	0.01205	1.04000	5.44983			
	6 BUTTOCK-KNE LGTH	0.02271	0.72970	9.72802			
	7 SHOULDR-ELB LGTH	0.00468	0.65060	4.32242			
	10 BIACROMIAL BRDTH	0.01325	0.23620	10.46027			
	12 HIP BREADTH	0.02781	0.01760	8.81113			
	14 CHEST DEPTH	0.02872	-0.15280	6.78696			
	15 FOOT LENGTH	0.00537	0.40610	4.08147			
	16 HAND LENGTH	0.00181	0.33420	2.57629			
	17 FORARM-HAND LGTH	0.00328	1.09897	3.53072			
1 WEIGHT	9 THUMB-TIP REACH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.030	26.358	1.426
		MASS		LENGTH	5.668	-5.585	19.508
	2 SITTING HEIGHT	0.02008	0.21630	26.36072			
	4 ACROMION HGT/SIT	0.02166	0.12730	16.25369			
	5 KNEE HGT/SITTING	0.01374	0.36090	8.15926			
	6 BUTTOCK-KNE LGTH	0.02312	0.27900	10.94946			
	7 SHOULDR-ELB LGTH	0.00456	0.26500	4.98305			
	10 BIACROMIAL BRDTH	0.01368	0.08050	11.11438			
	12 HIP BREADTH	0.02817	-0.00460	9.13904			
	14 CHEST DEPTH	0.02796	-0.03620	5.94550			
	15 FOOT LENGTH	0.00637	0.12980	5.43332			
	16 HAND LENGTH	0.00274	0.10320	3.78424			
	17 FORARM-HAND LGTH	0.00578	0.32440	7.89861			

Figure 43b. +ADD Function Output for Type 0 Member (Continued).

INDEPENDENT VARIABLES (MASS & LENGTH)	DEPENDENT VARIABLE	REGRESSION COEFFICIENTS (B1, B2, CNST)					
11 BIDELTIOD BRDTH	2 SITTING HEIGHT	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.346	30.120	1.200
		MASS			LENGTH	0.225	10.725	0.969
	2 SITTING HEIGHT	0.0	1.00000	0.0			
	4 ACROMION HGT/SIT	0.05010	0.72010	-3.33152			
	5 KNEE HGT/SITTING	0.20710	0.35780	4.89793			
	6 BUTTOCK-KNE LGTH	0.37550	0.24880	7.52394			
	7 SHOULDR-ELB LGTH	0.09000	0.22670	4.12759			
	10 BIACROMIAL BRDTH	0.46000	0.11040	3.24965			
	12 HIP BREADTH	0.41290	0.13030	1.26161			
	14 CHEST DEPTH	0.47690	-0.02880	1.61592			
	15 FOOT LENGTH	0.08730	0.15990	3.12040			
	16 HAND LENGTH	0.04510	0.10640	2.76362			
	17 FORARM-HAND LGTH	0.12055	0.28193	6.54733			
11 BIDELTIOD BRDTH	3 EYE HGT/SITTING	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.306	26.055	1.146
		MASS			LENGTH	0.221	11.940	0.975
	2 SITTING HEIGHT	0.04850	0.96830	4.90794			
	4 ACROMION HGT/SIT	0.07820	0.71960	-0.37902			
	5 KNEE HGT/SITTING	0.22220	0.35400	6.45692			
	6 BUTTOCK-KNE LGTH	0.38020	0.26500	8.11942			
	7 SHOULDR-ELB LGTH	0.09490	0.23950	4.71823			
	10 BIACROMIAL BRDTH	0.47150	0.08690	4.31225			
	12 HIP BREADTH	0.42010	0.12340	1.97291			
	14 CHEST DEPTH	0.48060	-0.03810	1.74185			
	15 FOOT LENGTH	0.09450	0.15660	3.85737			
	16 HAND LENGTH	0.05060	0.10190	3.31475			
	17 FORARM-HAND LGTH	0.14804	0.25471	8.40279			
11 BIDELTIOD BRDTH	5 KNEE HGT/SITTING	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.332	15.655	0.923
		MASS			LENGTH	0.350	11.304	0.949
	2 SITTING HEIGHT	0.14450	0.60490	20.65993			
	4 ACROMION HGT/SIT	0.14650	0.45090	11.17997			
	5 KNEE HGT/SITTING	0.0	1.00000	0.0			
	6 BUTTOCK-KNE LGTH	0.20380	0.77930	2.80354			
	7 SHOULDR-ELB LGTH	-0.00250	0.51650	2.86086			
	10 BIACROMIAL BRDTH	0.45400	0.13330	4.48622			
	12 HIP BREADTH	0.39650	0.18540	2.28117			
	14 CHEST DEPTH	0.44780	0.06400	-0.25567			
	15 FOOT LENGTH	0.03760	0.31720	2.96457			
	16 HAND LENGTH	0.01200	0.21110	2.65990			
	17 FORARM-HAND LGTH	0.00860	0.65549	4.77770			
11 BIDELTIOD BRDTH	6 BUTTOCK-KNE LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.464	14.975	0.956
		MASS			LENGTH	0.417	9.071	0.907
	2 SITTING HEIGHT	0.16330	0.39240	24.25101			
	4 ACROMION HGT/SIT	0.16470	0.28920	14.03161			
	5 KNEE HGT/SITTING	-0.00490	0.72680	4.76265			
	6 BUTTOCK-KNE LGTH	0.0	1.00000	0.0			
	7 SHOULDR-ELB LGTH	-0.04430	0.46060	4.04085			
	10 BIACROMIAL BRDTH	0.49490	0.00680	6.47457			
	12 HIP BREADTH	0.34720	0.23990	1.58527			
	14 CHEST DEPTH	0.41050	0.12680	-1.15616			
	15 FOOT LENGTH	0.02630	0.25160	4.15868			
	16 HAND LENGTH	0.00690	0.16220	3.53315			
	17 FORARM-HAND LGTH	-0.00209	0.49371	7.64600			

Figure 43c. +ADD Function Output for Type 0 Member (Continued).

INDEPENDENT VARIABLES (MASS & LENGTH)		DEPENDENT VARIABLE	REGRESSION COEFFICIENTS (B1, B2, CNST)				
11 BIDELTOID BRDTH	8 ELBOW-GRIP LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS				0.159	10.847	0.616
			MASS		LENGTH	0.399	13.470	0.977
		2 SITTING HEIGHT	0.21430	0.82050	21.24225			
		4 ACROMION HGT/SIT	0.20390	0.59450	11.92615			
		5 KNEE HGT/SITTING	0.14870	1.14650	3.24099			
		6 BUTTOCK-KNE LGTH	0.31600	0.91630	5.08151			
		7 SHOULDR-ELB LGTH	0.05850	0.69180	3.45386			
		10 BIACROMIAL BRDTH	0.46080	0.23480	4.02853			
		12 HIP BREADTH	0.42090	0.23260	2.66465			
		14 CHEST DEPTH	0.45960	0.05930	0.10500			
		15 FOOT LENGTH	0.07080	0.45180	3.03617			
		16 HAND LENGTH	0.02650	0.34850	2.18825			
		17 FORARM-HAND LGTH	0.04750	1.12507	2.83610			
11 BIDELTOID BRDTH	9 THUMB-TIP REACH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS				0.434	23.364	1.504
			MASS		LENGTH	0.180	13.292	0.969
		2 SITTING HEIGHT	0.21870	0.29080	23.33740			
		4 ACROMION HGT/SIT	0.20610	0.21300	13.39023			
		5 KNEE HGT/SITTING	0.15260	0.41130	6.05236			
		6 BUTTOCK-KNE LGTH	0.30800	0.35470	6.72016			
		7 SHOULDR-ELB LGTH	0.04600	0.28250	4.34560			
		10 BIACROMIAL BRDTH	0.46590	0.07440	4.83476			
		12 HIP BREADTH	0.42370	0.07900	3.34054			
		14 CHEST DEPTH	0.45120	0.04130	-0.21794			
		15 FOOT LENGTH	0.07670	0.15210	4.37728			
		16 HAND LENGTH	0.03300	0.11280	3.32874			
		17 FORARM-HAND LGTH	0.07418	0.34944	6.87477			
13 HIP BREADTH/SITT	2 SITTING HEIGHT	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS				0.463	29.794	1.178
			MASS		LENGTH	0.243	5.961	0.853
		2 SITTING HEIGHT	0.0	1.00000	0.0			
		4 ACROMION HGT/SIT	0.16860	0.69060	-3.80545			
		5 KNEE HGT/SITTING	0.28830	0.33460	5.39215			
		6 BUTTOCK-KNE LGTH	0.55050	0.20010	8.25307			
		7 SHOULDR-ELB LGTH	0.12330	0.21710	4.35481			
		10 BIACROMIAL BRDTH	0.19350	0.16690	7.03065			
		12 HIP BREADTH	0.71670	0.04980	1.39459			
		14 CHEST DEPTH	0.55390	-0.05510	3.43517			
		15 FOOT LENGTH	0.11060	0.15270	3.39454			
		16 HAND LENGTH	0.04320	0.10610	2.98915			
		17 FORARM-HAND LGTH	0.14863	0.27477	7.04002			
13 HIP BREADTH/SITT	3 EYE HGT/SITTING	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS				0.408	25.796	1.128
			MASS		LENGTH	0.238	7.309	0.861
		2 SITTING HEIGHT	0.07140	0.96220	4.95987			
		4 ACROMION HGT/SIT	0.20840	0.68780	-0.98418			
		5 KNEE HGT/SITTING	0.30880	0.33050	6.83155			
		6 BUTTOCK-KNE LGTH	0.55430	0.21860	8.57028			
		7 SHOULDR-ELB LGTH	0.13350	0.22980	4.88994			
		10 BIACROMIAL BRDTH	0.21340	0.14080	8.37065			
		12 HIP BREADTH	0.72070	0.04680	1.67072			
		14 CHEST DEPTH	0.55370	-0.06210	3.39681			
		15 FOOT LENGTH	0.12060	0.14910	4.09600			
		16 HAND LENGTH	0.05110	0.10100	3.54181			
		17 FORARM-HAND LGTH	0.17501	0.24575	8.88680			

Figure 43d. +ADD Function Output for Type 0 Member (Continued).

INDEPENDENT VARIABLES (MASS & LENGTH)	DEPENDENT VARIABLE	REGRESSION COEFFICIENTS (B1, B2, CNST)					
13 HIP BREADTH/SITT	5 KNEE HGT/SITTING	SIMPLE REGR (B1,CNST,SE) - LENGTH			FROM MASS	0.444	15.349	0.896
			MASS		LENGTH	0.377	6.595	0.826
	2 SITTING HEIGHT		0.20350	0.57860	20.95363			
	4 ACROMION HGT/SIT		0.31230	0.39230	10.77803			
	5 KNEE HGT/SITTING		0.0	1.00000	0.0			
	6 BUTTOCK-KNE LGTH		0.31980	0.72980	3.00100			
	7 SHOULDR-ELB LGTH		-0.00590	0.51790	2.87129			
	10 BIACROMIAL BRDTH		0.16940	0.22810	8.50694			
	12 HIP BREADTH		0.71570	0.05400	2.04980			
	14 CHEST DEPTH		0.51750	0.02530	1.40055			
	15 FOOT LENGTH		0.04170	0.31460	3.11505			
	16 HAND LENGTH		-0.00390	0.21680	2.82175			
	17 FORARM-HAND LGTH		-0.01968	0.66593	5.00474			
13 HIP BREADTH/SITT	6 BUTTOCK-KNE LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH			FROM MASS	0.643	14.209	0.890
			MASS		LENGTH	0.466	3.797	0.758
	2 SITTING HEIGHT		0.23370	0.35110	24.85822			
	4 ACROMION HGT/SIT		0.36570	0.18680	14.15387			
	5 KNEE HGT/SITTING		-0.03380	0.74060	4.84516			
	6 BUTTOCK-KNE LGTH		0.0	1.00000	0.0			
	7 SHOULDR-ELB LGTH		-0.08730	0.48290	3.96577			
	10 BIACROMIAL BRDTH		0.19090	0.12340	10.25960			
	12 HIP BREADTH		0.70410	0.05520	2.09503			
	14 CHEST DEPTH		0.48240	0.07200	0.76467			
	15 FOOT LENGTH		0.01730	0.25450	4.33329			
	16 HAND LENGTH		-0.02030	0.17460	3.67240			
	17 FORARM-HAND LGTH		-0.05840	0.51972	7.84154			
13 HIP BREADTH/SITT	8 ELBOW-GRIP LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH			FROM MASS	0.202	10.851	0.610
			MASS		LENGTH	0.409	9.213	0.867
	2 SITTING HEIGHT		0.30100	0.78230	21.36334			
	4 ACROMION HGT/SIT		0.38070	0.51940	11.17498			
	5 KNEE HGT/SITTING		0.21610	1.11700	3.25841			
	6 BUTTOCK-KNE LGTH		0.47070	0.84900	5.01346			
	7 SHOULDR-ELB LGTH		0.08550	0.68000	3.45666			
	10 BIACROMIAL BRDTH		0.20230	0.33550	8.37363			
	12 HIP BREADTH		0.71820	0.10550	1.73571			
	14 CHEST DEPTH		0.52300	0.02770	1.48880			
	15 FOOT LENGTH		0.09130	0.44260	3.15125			
	16 HAND LENGTH		0.02100	0.35050	2.35251			
	17 FORARM-HAND LGTH		0.04861	1.12413	3.02811			
13 HIP BREADTH/SITT	9 THUMB-TIP REACH	SIMPLE REGR (B1,CNST,SE) - LENGTH			FROM MASS	0.513	23.986	1.497
			MASS		LENGTH	0.171	9.463	0.865
	2 SITTING HEIGHT		0.31810	0.27540	23.24312			
	4 ACROMION HGT/SIT		0.39220	0.18270	12.42797			
	5 KNEE HGT/SITTING		0.23820	0.39780	5.83377			
	6 BUTTOCK-KNE LGTH		0.47410	0.32860	6.34104			
	7 SHOULDR-ELB LGTH		0.08120	0.27690	4.19169			
	10 BIACROMIAL BRDTH		0.20750	0.12240	9.07808			
	12 HIP BREADTH		0.72380	0.03080	2.14232			
	14 CHEST DEPTH		0.51100	0.03450	0.96138			
	15 FOOT LENGTH		0.10500	0.14790	4.40562			
	16 HAND LENGTH		0.03400	0.11290	3.44645			
	17 FORARM-HAND LGTH		0.09851	0.34594	6.92857			

Figure 43e. +ADD Function Output for Type 0 Member (Continued).

INDEPENDENT VARIABLES (MASS & LENGTH)	DEPENDENT VARIABLE	REGRESSION COEFFICIENTS (B1, B2, CNST)					
14 CHEST DEPTH	2 SITTING HEIGHT	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.215	34.615	1.239
			MASS	LENGTH	0.079	6.749	0.753
		2 SITTING HEIGHT	0.0	1.00000	0.0		
		4 ACROMION HGT/SIT	0.14370	0.72000	-3.76470		
		5 KNEE HGT/SITTING	0.28740	0.38170	5.18029		
		6 BUTTOCK-KNE LGTH	0.52160	0.29210	8.03195		
		7 SHOULDR-ELB LGTH	0.13950	0.23620	4.17877		
		10 BIACROMIAL BRDTH	0.22650	0.19570	6.64778		
		12 HIP BREADTH	0.52910	0.18140	2.12145		
		14 CHEST DEPTH	1.00000	0.0	0.0		
		15 FOOT LENGTH	0.11460	0.17040	3.28406		
		16 HAND LENGTH	0.06150	0.11170	2.83253		
		17 FORARM-HAND LGTH	0.17581	0.29698	6.73949		
14 CHEST DEPTH	3 EYE HGT/SITTING	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.168	30.252	1.180
			MASS	LENGTH	0.069	7.469	0.755
		2 SITTING HEIGHT	0.05130	0.97550	5.10303		
		4 ACROMION HGT/SIT	0.17690	0.72480	-0.76884		
		5 KNEE HGT/SITTING	0.30530	0.38230	6.82635		
		6 BUTTOCK-KNE LGTH	0.53200	0.32170	8.68135		
		7 SHOULDR-ELB LGTH	0.14430	0.25070	4.77250		
		10 BIACROMIAL BRDTH	0.24130	0.17460	8.14076		
		12 HIP BREADTH	0.53790	0.17960	2.96665		
		14 CHEST DEPTH	1.00000	0.0	0.0		
		15 FOOT LENGTH	0.12290	0.16910	4.06737		
		16 HAND LENGTH	0.06730	0.10850	3.41576		
		17 FORARM-HAND LGTH	0.19359	0.27420	8.72444		
14 CHEST DEPTH	5 KNEE HGT/SITTING	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.367	18.411	0.942
			MASS	LENGTH	0.219	4.836	0.728
		2 SITTING HEIGHT	-0.03050	0.66210	22.44211		
		4 ACROMION HGT/SIT	0.11910	0.48380	12.26425		
		5 KNEE HGT/SITTING	0.0	1.00000	0.0		
		6 BUTTOCK-KNE LGTH	0.29420	0.78560	3.69406		
		7 SHOULDR-ELB LGTH	-0.00460	0.51660	2.85458		
		10 BIACROMIAL BRDTH	0.17700	0.25290	8.77199		
		12 HIP BREADTH	0.48800	0.21640	4.42040		
		14 CHEST DEPTH	1.00000	0.0	0.0		
		15 FOOT LENGTH	0.03170	0.32340	3.23744		
		16 HAND LENGTH	0.00640	0.21390	2.76474		
		17 FORARM-HAND LGTH	-0.00237	0.65902	4.88638		
14 CHEST DEPTH	6 BUTTOCK-KNE LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS			0.584	18.143	0.967
			MASS	LENGTH	0.298	2.579	0.690
		2 SITTING HEIGHT	-0.06660	0.48010	25.90938		
		4 ACROMION HGT/SIT	0.10740	0.32580	15.25306		
		5 KNEE HGT/SITTING	-0.06570	0.74430	4.88775		
		6 BUTTOCK-KNE LGTH	0.0	1.00000	0.0		
		7 SHOULDR-ELB LGTH	-0.08740	0.46820	3.86291		
		10 BIACROMIAL BRDTH	0.17690	0.16000	10.52173		
		12 HIP BREADTH	0.41560	0.26060	3.67241		
		14 CHEST DEPTH	1.00000	0.0	0.0		
		15 FOOT LENGTH	-0.00280	0.26340	4.40554		
		16 HAND LENGTH	-0.01340	0.16910	3.63065		
		17 FORARM-HAND LGTH	-0.05816	0.50981	7.76975		

Figure 43f. +ADD Function Output for Type 0 Member (Continued).

INDEPENDENT VARIABLES (MASS & LENGTH)		DEPENDENT VARIABLE	REGRESSION COEFFICIENTS (B1, B2, CNST)				
14 CHEST DEPTH	8 ELBOW-GRIP LGTH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS				0.168	12.235	0.624
		MASS			LENGTH	0.239	6.337	0.744
		2 SITTING HEIGHT	0.06190	0.89100	23.73834			
		4 ACROMION HGT/SIT	0.19050	0.62960	13.47361			
		5 KNEE HGT/SITTING	0.17040	1.16450	4.17059			
		6 BUTTOCK-KNE LGTH	0.42380	0.93950	6.66929			
		10 BIACROMIAL BRDTH	0.20750	0.36830	8.92597			
		7 SHOULDR-ELB LGTH	0.06680	0.69890	3.82100			
		12 HIP BREADTH	0.52110	0.27410	5.05256			
		14 CHEST DEPTH	1.00000	0.0	0.0			
		15 FOOT LENGTH	0.07210	0.46250	3.53542			
		16 HAND LENGTH	0.02520	0.35300	2.38703			
		17 FORARM-HAND LGTH	0.04897	1.13228	3.16556			
14 CHEST DEPTH	9 THUMB-TIP REACH	SIMPLE REGR (B1,CNST,SE) - LENGTH FROM MASS				0.520	26.598	1.516
		MASS			LENGTH	0.122	5.792	0.735
		2 SITTING HEIGHT	0.04480	0.32460	25.99103			
		4 ACROMION HGT/SIT	0.17890	0.22810	15.09896			
		5 KNEE HGT/SITTING	0.15000	0.42030	7.21663			
		6 BUTTOCK-KNE LGTH	0.39570	0.36160	8.53055			
		7 SHOULDR-ELB LGTH	0.03690	0.28630	4.74527			
		10 BIACROMIAL BRDTH	0.20080	0.13340	9.87646			
		12 HIP BREADTH	0.52020	0.09140	5.97084			
		14 CHEST DEPTH	1.00000	0.0	0.0			
		15 FOOT LENGTH	0.06930	0.15740	4.99869			
		16 HAND LENGTH	0.02510	0.11570	3.62286			
		17 FORARM-HAND LGTH	0.05436	0.35618	7.54590			

CBM3291 MEMBER REGRESO1,WITH 17 ANTHROPOMETRIC VARIABLES AND 24 X 11 SETS OF REGRESSION EQUATIONS, HAS BEEN ADDED.

Figure 43g. +ADD Function Output for Type 0 Member (Conclusion).

ppp.pp$_1$ -
ppp.pp$_{npct}$ } are the percentile values associated with each percentile name for the particular anthropometric variable

An example of this fifth format is shown in Figure 44a-b.

3.4 PROGRAM MESSAGES INCLUDING ERROR CORRECTION

The program CBMAM prints out both instructional and action messages. The message format for both is as follows:

CBM3nni message text

where:
- nn — is the message number
- i — identifies the action code (I = informational, A = action to be performed), and
- message text — is the text of the message.

Unless otherwise noted, all messages are issued by the routine CBMADM.

The messages in affect to date are as follows:

CBM300I Control card image

Reason: The user has submitted a control card.
System Action: None
User Action: None

CBM301A Operation - UNKNOWN OPERATION.
Reason: The operation on the control card (shown in the previous CBM300I Message) is unknown.
System Action: The control card is ignored.
User Action: Correct the card, using a valid operation, and resubmit.

CBM302I INITIALIZED.
Reason: The user requested that the Anthropometric data base be initialized via the Initialized Anthropometric Data Base Function (+INT).
System Action: The data base is initialized.
User Action: None

CBM3001 +ADD 67SURVEY 1 17 24 11 25 REGRESOL
CBM3131 MEMBER 67SURVEY IS TYPE 1 AND CONTAINS 17 ANTHROPOMETRIC VARIABLE NAMES.

NO.	VARIABLE NAME	UNIT	MEAN	STDV	PERCENTILES									
					1	2	3	5	10	15	20	25	30	35
					40	45	50	55	60	65	70	75	80	85
					90	95	97	98	99					
1.)	WEIGHT	LB	173.61	21.435	127.58	132.63	135.82	140.15	146.89	151.53	155.27	158.56	161.56	164.37
					167.08	169.74	172.42	175.13	177.92	180.84	183.97	187.41	191.32	195.91
					201.83	210.76	216.62	220.94	227.73					
2.)	SITTING HEIGHT	IN	36.69	1.250	33.94	34.24	34.44	34.70	35.11	35.39	35.62	35.82	36.00	36.17
					36.33	36.49	36.65	36.81	36.98	37.15	37.33	37.53	37.75	38.01
					38.33	38.80	39.10	39.31	39.62					
3.)	EYE HGT/SITTING	IN	31.87	1.187	29.17	29.50	29.71	29.98	30.38	30.65	30.87	31.06	31.23	31.38
					31.53	31.68	31.83	31.98	32.13	32.29	32.46	32.65	32.86	33.11
					33.43	33.90	34.21	34.43	34.78					
4.)	ACROMION HGT/SIT	IN	24.04	1.123	21.42	21.77	21.97	22.24	22.63	22.89	23.10	23.27	23.43	23.58
					23.73	23.87	24.01	24.15	24.30	24.45	24.61	24.79	24.99	25.22
					25.51	25.94	26.20	26.39	26.66					
5.)	KNEE HGT/SITTING	IN	21.96	0.580	19.13	19.98	20.15	20.37	20.71	20.95	21.13	21.29	21.43	21.57
					21.69	21.82	21.94	22.06	22.19	22.31	22.45	22.60	22.77	22.96
					23.22	23.60	23.86	24.05	24.36					
6.)	BUTTOCK-KNE LGTH	IN	23.78	1.062	21.38	21.65	21.83	22.07	22.44	22.69	22.89	23.06	23.22	23.36
					23.50	23.63	23.76	23.89	24.02	24.16	24.31	24.47	24.65	24.86
					25.14	25.57	25.87	26.10	26.48					
7.)	SHOULDR-ELB LGTH	IN	14.15	0.674	12.65	12.81	12.91	13.06	13.29	13.45	13.57	13.68	13.79	13.88
					13.97	14.06	14.14	14.23	14.32	14.41	14.51	14.61	14.73	14.86
					15.03	15.28	15.44	15.55	15.73					
8.)	ELBOW-GRIP LGTH	IN	13.86	0.636	12.47	12.61	12.70	12.83	13.04	13.19	13.31	13.42	13.51	13.60
					13.69	13.77	13.85	13.93	14.01	14.10	14.19	14.29	14.40	14.52
					14.69	14.93	15.09	15.21	15.40					
9.)	THUMB-TIP REACH	IN	31.62	1.565	28.04	28.46	28.72	29.08	29.64	30.01	30.30	30.56	30.79	31.00
					31.20	31.39	31.58	31.78	31.98	32.18	32.40	32.64	32.91	33.22
					33.64	34.27	34.69	35.02	35.55					
10.)	BIACROMIAL BRDTH	IN	16.03	0.764	14.18	14.41	14.56	14.75	15.05	15.25	15.41	15.54	15.66	15.76
					15.86	15.96	16.05	16.14	16.24	16.33	16.43	16.54	16.66	16.80
					16.98	17.26	17.44	17.58	17.82					
11.)	BIDELTOID BRDTH	IN	18.99	1.008	16.67	16.96	17.14	17.37	17.72	17.95	18.14	18.30	18.44	18.58
					18.71	18.84	18.96	19.09	19.22	19.36	19.51	19.67	19.85	20.05
					20.32	20.71	20.97	21.15	21.42					
12.)	HIP BREADTH	IN	13.88	0.742	12.21	12.41	12.54	12.71	12.97	13.14	13.28	13.39	13.50	13.59
					13.68	13.77	13.86	13.95	14.04	14.13	14.23	14.34	14.47	14.62
					14.82	15.15	15.37	15.55	15.84					
13.)	HIP BREADTH/SITT	IN	14.88	0.906	12.86	13.10	13.25	13.45	13.75	13.96	14.12	14.26	14.39	14.51
					14.62	14.73	14.84	14.95	15.06	15.18	15.31	15.45	15.61	15.80
					16.05	16.44	16.70	16.90	17.23					
14.)	CHEST DEPTH	IN	9.65	0.758	7.58	8.14	8.25	8.41	8.67	8.85	9.00	9.13	9.25	9.36
					9.46	9.56	9.65	9.75	9.85	9.94	10.05	10.16	10.29	10.43
					10.62	10.90	11.10	11.24	11.49					
15.)	FOOT LENGTH	IN	10.64	0.468	9.57	9.70	9.79	9.89	10.06	10.17	10.25	10.33	10.39	10.46
					10.52	10.57	10.63	10.69	10.75	10.81	10.88	10.95	11.03	11.13
					11.25	11.44	11.56	11.65	11.80					

Figure 44a. Example of Program CBMAM +ADD Function Output for Type 1 Member.

16.) HAND LENGTH	IN	7.52	0.323	6.79	6.88	6.93	7.00	7.11	7.19	7.25	7.30	7.35	7.39
				7.43	7.47	7.51	7.55	7.60	7.64	7.69	7.74	7.79	7.86
				7.94	8.07	8.15	8.21	8.30					
17.) FORARM-HAND LGTH	IN	19.33	0.802	17.52	17.72	17.85	18.03	18.31	18.50	18.65	18.78	18.90	19.01
				19.12	19.22	19.32	19.42	19.53	19.63	19.75	19.87	20.01	20.17
				20.37	20.67	20.86	21.00	21.22					

CBM330I MEMBER 67SURVEY, WITH 17 ANTHROPOMETRIC VARIABLES AND 25 PERCENTILES, AND REFERENCING SURVEY REGRESOI, HAS BEEN ADDED.

Figure 44b. +ADD Function Output for Type 1 Member.

CBM303A NO NAME GIVEN; operation IGNORED.

Reason: The operation specified on the control card requires a membername to be specified with the operation, but no name was supplied.

System Action: The control card and subsequent data, if any, are ignored.

User Action: Correct the card, adding the appropriate additional information as required in the definition of the specific operation, and resubmit with data, if any.

CBM304A TYPE SPECIFICATION INVALID FOR MEMBER membername.

Reason: An invalid type code, that is, a type code other than 0 or 1, was given for the specified member.

System Action: Control card, and any subsequent data, are ignored.

User Action: Check to see that integer type code is right justified in the appropriate field on the card. Correct code and resubmit with any data.

CBM305A NUMBER OF ANTHROPOMETRIC DIMENSIONS INVALID FOR MEMBER membername.

Reason: The numberof anthropometric dimensions specified for the given member on either the +ADD or +CHK control card was either less than one or greater than 25.

System Action: Control card and any subsequent data are ignored.

User Action: Check to see that the integer value was right justified in the field on the card. Correct value and resubmit with any data.

CBM306A NUMBER OF COMBINATIONS OF INDEPENDENT VARIABLES INVALID FOR MEMBER membername.

Reason: The number of combinations of independent variables (the product of the number of mass related variables and the number of length related variables) for the +ADD or +CHK control card is less than one or greater than 50, for the member specified.

System Action: The control card and any subsequent data is ignored.

User Action: Check to see that the integer value is right justified in the field. Correct the card and resubmit with any data.

CBM307A NUMBER OF DEPENDENT VARIABLES INVALID FOR MEMBER membername.

Reason: The number of dependent variables specified on the +ADD or +CHK control card was less than one or greater than 15 for the indicated member.

System Action: The control card and any subsequent data is ignored.

User Action: Check to see that the integer value is right justified in the field. Correct the card and resubmit with any data.

CBM308A NUMBER OF PERCENTILES INVALID FOR MEMBER membername.
Reason: The number of percentiles specified on the +ADD or +CHK control card was less than one or greater than 30 for the indicated member.
System Action: The control card and subsequent data is ignored.
User Action: Check that the integer value is right justified in the field. Correct number and resubmit with data.

CBM309A ILLEGAL CONTROL CARD FOR MEMBER membername DUE TO nn ERRORS.
Reason: Control card format invalid. The system found nn errors which need to be corrected.
System Action: Control card and any subsequent data are ignored.
User Action: Correct the card and resubmit with any data.

CBM310A INSUFFICIENT SPACE REMAINING TO ADD MEMBER membername.
Reason: The data base does not have a sufficient number of continuous unused records to add the specified member.
System Action: The member is not added to the data base.
User Action: Run the program CBMAM with the +CMP control card, followed by the request to add the specified member. If the CBM310A message reappears, members will have to be deleted (using the +DEL function) before any new members can be added.

CBM311A DIRECTORY IF FULL, CANNOT ADD membername.
Reason: The data base directory, which contains the location of each member within the file, can hold a maximum of 20 entries. The member specified would be 21, and cannot be added.
System Action: The member is not added to the data base.
User Action: A member will have to be deleted before any new member can be added.

CBM312A MEMBER membername IS NOT FOUND IN THE DIRECTORY.
Reason: The type 0 member membername which was referenced by the type 1 member is not in the directory.
System Action: The control card and data are ignored.
User Action: Check that the type 0 member was specified correctly. Be sure it has been added to the data base before rerunning the control card and data.

CBM313I MEMBER, membername IS TYPE tt AND CONTAINS nn ANTHROPOMETRIC VARIABLE NAMES.
Reason: The +ADD or +CHK control card has been read in for the specified member, and the type field and the number of variables have been accepted.
System Action: None
User Action: None

CBM314I MEMBER ALSO CONTAINS nn ADDITIONAL RECORDS, EACH CONTAINING THE REGRESSION COEFFICIENTS FOR mm DEPENDENT VARIABLES.
Reason: Message is printed for +ADD or +CHK control card for type 0 members. It provides information on the number of additional records associated with the previously specified member.
System Action: None
User Action: None

CBM315A VARIABLE variable name 1 HAS THE SAME NUMBER AS VARIABLE variable name 2.
Reason: Each variable entered as part of a type 0 or type 1 member must have a unique number.
System Action: Record which defines variable name 1 is flagged as containing an error. Member may not be added.
User Action: Correct number and reenter member.

CBM316A variable name USED IN VARIABLES n1 AND n2.
Reason: Each variable number must have a unique variable name.
System Action: Record which contains variable number n2 is flagged as containing an error. Member may not be added.
User Action: Correct record and reenter member.

CBM317A variable name IS NEITHER DEPENDENT OR INDEPENDENT.
Reason: An anthropometric variable must be defined as either dependent, that is one necessary for the creation of the link system of the model, or independent, that is a variable highly correlated to body segment mass or body segment length. This variable has not been flagged as either.
System Action: The record is flagged as containing an error, and the member may not be added to the data base.
User Action: Punch a "1" in either column 16, 30, or 34, depending on the type of variable. Resubmit member.

CBM318A variable name IS INDEPENDENT VARIABLE FOR BOTH MASS AND LENGTH.

Reason: An anthropometric variable may be an independent variable correlated to either mass or length, but not both.

System Action: The record is flagged as containing an error, and the member may not be added to the data base.

User Action: Delete the punch from either column 26 or 30. Resubmit member.

CBM319A MEMBER membername CONTAINS TOO MANY INDEPENDENT VARIABLES.

Reason: The number of combinations of independent variables (number of mass variables x number of length variables) encountered must be equal to the number of combinations specified on the +ADD or +CHK control card.

System Action: Member is not added to data base.

User Action: Verify the totals, make the appropriate corrections, and resubmit the member.

CBM320A MEMBER membername CONTAINS TOO MANY DEPENDENT VARIABLES.

Reason: The number of dependent variables encountered must be equal to the number of dependent variables specified on the +ADD or +CHK control card.

System Action: Member is not added to the data base.

User Action: Verify the total, make appropriate corrections, and resubmit the member definition.

CBM321A UNIT OF MEASUREMENT, uu FOR VARIABLE variable name IS NOT PERMISSIBLE.

Reason: Valid units of measurement are IN, CM, MM, LB, or KG, only.

System Action: The record is flagged and the member is not added to the data base.

User Action: Supply a valid unit of measurement, and resubmit the member definition.

CBM322A DATA CARD IMAGE multiple regression coefficient card image OUT OF SEQUENCE.

Reason: For each combination of independent variables, a total of NDEP + 1 records must be supplied, each beginning with the same two variable numbers specifying the mass and length variable.

System Action: The record is flagged and the member is not added to the data base.

User Action: Check that the integers were right justified in their fields; correct the error and resubmit the member definition.

CBM323A VARIABLE variable name IS NOT AN INDEPENDENT VARIABLE PERTAINING TO MASS.

Reason: The variable number supplied in column 1-3 of the regression data cards shoud correspond to a variable name defined as a mass related independent variable on one of the anthropometric varible definition cards. (See Figure 3.6)

System Action: The record is flagged and the member is not added to the data base.

User Action: Check that the integer is right justified in the field and verify the value, correct the error and resubmit the member definition.

CBM324A VARIABLE variable name IS NOT AN INDEPENDENT VARIABLE PERTAINING TO LENGTH.

Reason: The variable number supplied in column 4-6 of the regression definition data cards should correspond to a variable name defined as a length related independent variable on one of the anthropometric variable definition cards. (See Figure 3.6)

System Action: The record is flagged and the member is not added to the data base.

User Action: Check that the integer is right justified in the field and verify the value; correct the error and resubmit the member definition.

CBM325A VARIABLE variable name IS NOT A DEPENDENT VARIABLE.

Reason: The variable number supplied in column 7-9 of the multiple regression data definition cards should correspond to a variable name defined as a dependent variable on one of the anthropometric variable definition cards. (See Figure 3.6)

System Action: The record is flagged and the member is not added to the data base.

User Action: Check that the integer is right justified in the field and verify the value, correct the error and resubmit the member definition.

CBM326A VARIABLE nn OUT OF SEQUENCE.

Reason: For a type 1 member definition, the survey definition cards must be read in with the variable numbers in ascending order, starting with variable number 1 and ending with variable number NVBL.

System Action: The record is flagged and the member is not added to the data base.

User Action: Check that the integer is right justified in the field. Make necessary corrections and resubmit the member definition.

CBM327A variable name IN MEMBER survey membername DOES NOT CORRESPOND TO VARIABLE nn IN regression membername.
Reason: The variable names and numbers in the type 1 member survey membername should correspond exactly to the names and numbers in the referenced type 0 member regression membername.
System Action: The record in the type 1 member definition is flagged and the member is not added to the data base.
User Action: Verify the survey definition variable number and name against the regression, or type 0 member, and make necessary corrections. Resubmit type 1 member definition.

CBM328A ANTHROPOMETRIC DIMENSION LT OR EQ TO ZERO.
Reason: Dimensions supplied in the survey member definition cards must be positive real numbers.
System Action: The record is flagged and the member is not added.
User Action: Check on the value, correct and resubmit the member definition.

CBM329I MEMBER regression membername, WITH nn ANTHROPOMETRIC VARIABLES AND nn_1 X nn_2 SETS OF REGRESSION EQUATIONS, HAS BEEN ADDED.
Reason: The type 0 member definition was checked to be syntactically correct, and has been added to the data base.
System Action: The member has been added to the data base.
User Action: None

CBM330I MEMBER survey membername, WITH nn ANTHROPOMETRIC VARIABLES AND nn_1 PERCENTILES, AND REFERENCING SURVEY regression membername HAS BEEN ADDED.
Reason: The type 1 member definition was checked and found to be syntactically correct, and has been added to the data base.
System Action: The member has been added to the data base.
User Action: None

CBM331A membername HAS NOT BEEN ADDED DUE TO nnn ERRORS.
Reason: After checking the member definition, nnn syntax errors were found.
System Action: The member is not added to the data base.
User Action: Correct the errors, and resubmit the member definition.

CBM332A MEMBER membername CHECKED - nnnnn ERRORS.
Reason: After checking the member definition, nnnnn syntax errors were found.
System Action: None
User Action: Correct the errors and resubmit the member definition.

CBM333I MEMBER membername DELETED.
Reason: User requested function to delete a member performed successfully.
System Action: Member deleted from data base.
User Action: None

CBM334I membername NOW IN PLACE.
Reason: User requested +CMP function has caused member to be moved within data base, combining unused space.
System Action: Directory index in data base updated. Compression continues.
User Action: None

CBM335I membername WAS IN PLACE.
Reason: User requested +CMP function found member to be in optimum place and did not need to be moved.
System Action: Compression continues.
User Action: None

CBM336I COMPRESS FINISHED.
Reason: Successful completion of +CMP function.
System Action: None
User Action: None

CBM337I membername PUNCHED.
Reason: User initiated +PCH function for member membername successfully completed.
System Action: Punching is completed.
User Action: None

CBM339A END-OF-DATA.
Reason: The end of control cards was found before the End Program Control Card (+END) was found.
System Action: End of job.
User Action: Check to be sure all control cards were processed.

CBM340A MEMBER membername ALREADY EXISTS.
Reason: The user has tried to add an anthropometric member definition under a name that already exists in the data base.
System Action: The control card is ignored.
User Action: Use a new name; resubmit the member.

CBM341A DATABASE IS NOT AN ANTHROPOMETRIC DATABASE
Reason: First record of file does not contain " ANTH" identification field.
System Action: Terminate the program.
User Action: Consult with systems programmer.

CBM342A I/0 ERROR ON RECORD nnnnn (INDEX).
Reason: An I/0 error has occurred in the directory on the Anthropometric Data Base.
System Action: Terminate the program.
User Action: Contact the systems programmer.

CBM343A I/0 ERROR ON RECORD nnnnn (DATA).
Reason: An I/0 error has occurred in a member definition on the Anthropometric Data Base.
System Action: Terminate the program.
User Action: Contact the systems programmer.

CBM399I PROGRAM END.
Reason: Either the +END Control Card was encountered, the end of the deck of control cards was encountered, or there was an I/0 error.
System Action: Terminate the program.
User Action: Check to be sure that all control cards were accepted, and processed correctly.

SECTION 4

WORKSPACE DATA BASE MAINTENANCE PROGRAM (CBMWM)

One of the primary benefits of COMBIMAN is its use as a tool for evaluating workspaces. Many times these workspaces will have been designed and in use, or may exist only on an engineer's drawing. The best way to make these workspaces available to the man-model in the interactive graphics program CBM04 is to store the three dimensional coordinates of the panels and controls of the workspace on a data base accessed by CBM04. The program CBMWM was developed to assist the user in creating and maintaining the workspace data base. The data flow for the program CBMWM is shown in Figure 45.

The Workspace Data Base contains the set of Worksapce definitions which geometrically describe the workspace, such as an aircraft cockpit, or driver's area of an automobile, in three-dimensional space. Each workspace definition is divided into the definitions of the panels of the workspace, and the definition of controls found on and about the defined panels. Each workspace definition in the Workspace Data Base is called a member, and is referenced by the member's name.

4.1 PROCESSING PERFORMED

The program allows the user to create and maintain the Workspace Data Base. Input supplied by the user in 80 character computer card format, or in card image format (80 character records) on magnetic tape is read into the program CBMWM and processed according to the user's selection of control card commands. These commands allow the user to add members to the data base, delete members from the data base, print or punch existing members onto computer cards, list the contents of the data base, or to compress data together on the file, thus combining unused records together to achieve larger blocks of available storage.

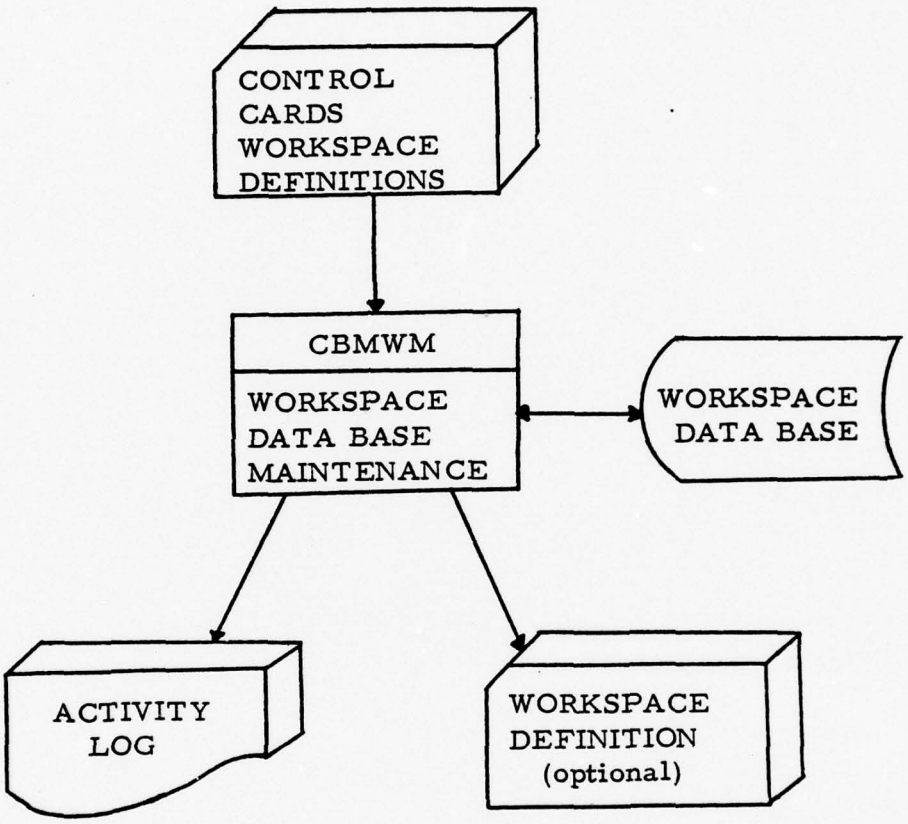


Figure 45. Data Flow for Program CBMWM.

The control cards for CBMWM may be in any order in the input to the program, with one exception. If the data base is being created for the first time, or is to be reinitialized, the $INT (Initialize) control card must preceed all other control cards and member definitions.

4.2 RESTRICTIONS AND LIMITATIONS

A maximum of 20 members may be added to the Workspace Data Base. The number of records each member may contain is variable, but the sum of the record counts for all the members may not exceed 1979 records. Information on the number of members on the data base and their size may be obtained by using the $PRT control card, omitting a reference to a membername. Membernames are limited to 8 alphanumeric characters. A maximum of 300 panels and 300 controls may be contained in any one member definition. Any additional limitations will be described in Paragraph 4.3.2, "Specifying Processing."

4.3 HOW TO USE PROGRAM CBMWM

The example used to illustrate this program is based upon the workspace in Figure 46. The workspace consists of a seven-drawer desk. In modeling the desk, only the desk's top, front side, and leg well were used. The other sides are not needed because they will cause no physical or visual interference to a man-model seated in the usual position at a desk.

4.3.1 Specifying the Input Data

Using the dimensions of the desk and the origin as indicated in the figure, three dimensional coordinates were obtained for the various vertices of the panels and for the locations of the controls. The program CBMWM has been set up so that workspaces defined in any three dimensional coordinate system can be entered into the data base. The coordinate system for COMBIMAN is a right handed system with positive x forward, positive y to the left, and positive z up. The user must supply the program CBMWM

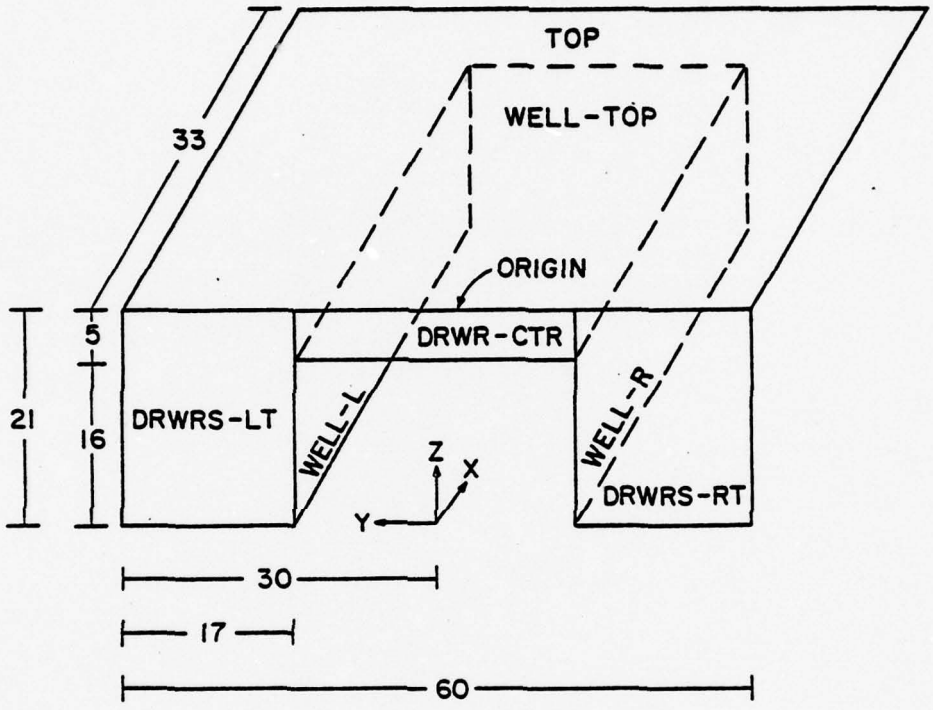


Figure 46. Sample Workspace - DESK.

with the three-dimensional coordinates of the Seat Reference Point (SRP) with respect to the origin of the workspace coordinate system, and with the direction of the positive x, y, and z axes of the workspace. Directions of x, y and z are either F for forward, A for aft, L for left, R for right, U for up or D for down. Directions are from the view of the seated operator in the workspace. From these data, the program converts all input coordinates of the panels and controls to the coordinate system of the COMBIMAN model.

Panels for the workspace must have from three to six vertices. The panels must be convex, that is for panels of four to six vertices, a line drawn from any vertex to another must lie within the bounds of that panel. Vertices are entered into the program consecutively, going either clockwise or counterclockwise along the perimeter of the panel. Some examples of valid and invalid panels are shown in Figure 47. A total of seven panels make up the workstation "DESK" in the example. Each of the panels has four vertices, and is rectangular in shape. The coordinates of the vertices of each panel is shown in Figure 48.

Controls are defined by absolute or relative coordinates. If the control is not placed on a defined panel of the workstation, it must be defined in absolute coordinates, where the x, y, and z coordinates of the control are given relative to the origin of the workstation coordinate system. Before being stored on the data base the coordinates are translated and rotated to the COMBIMAN system of coordinates.

If the control is located within a defined panel, and on the plane defined by that panel, coordinates can be given relative to a named vertex of the panel. In this instance, an x- and a y-displacement are given from the vertex number specified. The z-value must be zero. The x-displacement is the offset from the vertex number n in the direction of the line connecting vertex_n and vertex_{n-1}. The y-displacement is the displacement in the direction of the line connecting vertex_n and vertex_{n+1}. The convention for determining the location of a control in a panel relative to the vertices of the panel is shown in Figure 49.

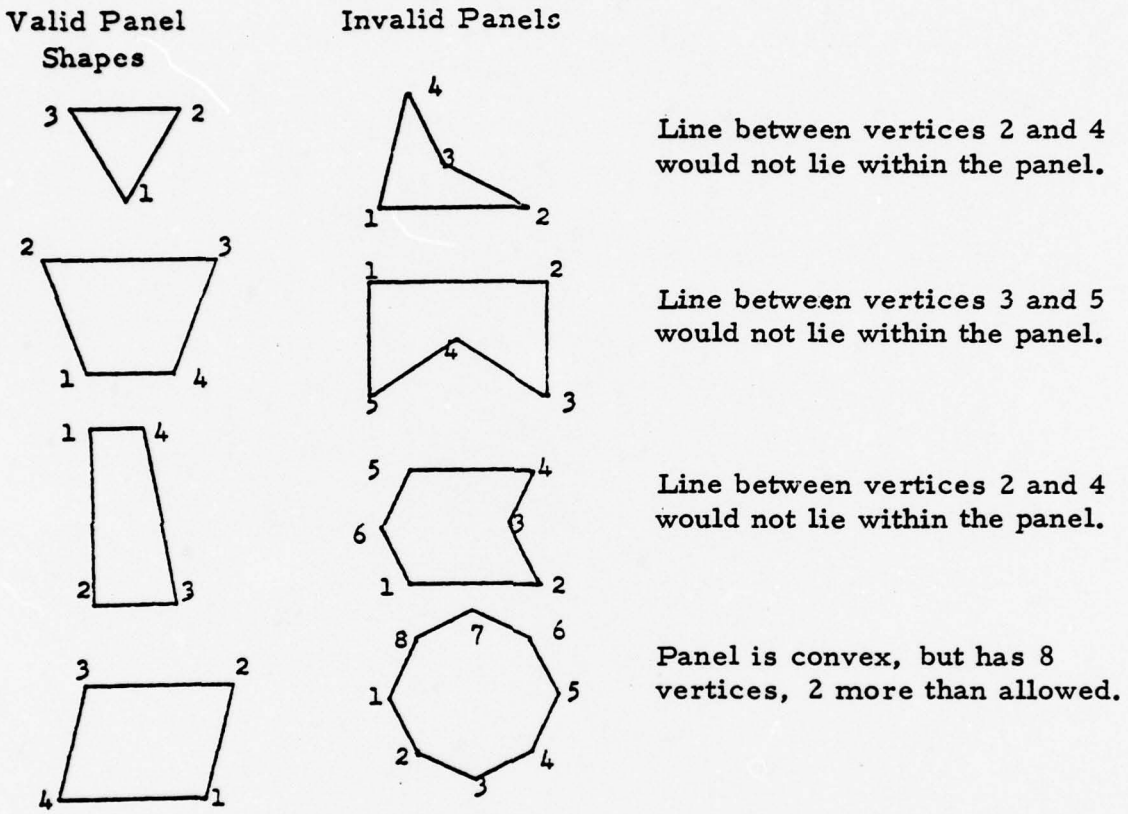
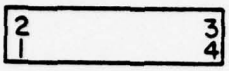


Figure 47. Example of Valid and Invalid Panels.



1 TOP

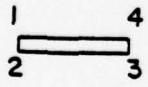
POINT	X	Y	Z
1	0.0	30.0	0.0
2	33.0	30.0	0.0
3	33.0	-30.0	0.0
4	0.0	-30.0	0.0

2 DRWRS - LT

POINT	X	Y	Z
1	0.0	30.0	0.0
2	0.0	13.0	0.0
3	0.0	13.0	-21.0
4	0.0	30.0	-21.0

3 DRWRS - RT

POINT	X	Y	Z
1	0.0	-30.0	0.0
2	0.0	-13.0	0.0
3	0.0	-13.0	-21.0
4	0.0	-30.0	-21.0



4 DRWRS - CT

POINT	X	Y	Z
1	0.0	13.0	0.0
2	0.0	13.0	-5.0
3	0.0	-13.0	-5.0
4	0.0	-13.0	0.0

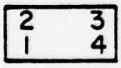
Figure 48a. X, Y and Z Coordinates of Panels of DESK.

5WELL - LT

POINT	X	Y	Z
1	0.0	13.0	-5.0
2	0.0	13.0	-21.0
3	33.0	13.0	-21.0
4	33.0	13.0	-5.0

6WELL - RT

POINT	X	Y	Z
1	0.0	-13.0	-5.0
2	0.0	-13.0	-21.0
3	33.0	-13.0	-21.0
4	33.0	-13.0	-5.0



7WELL - TOP

POINT	X	Y	Z
1	0.0	13.0	-5.0
2	33.0	13.0	-5.0
3	33.0	-13.0	-5.0
4	0.0	-13.0	-5.0

Figure 48b. X, Y and Z Coordinates of Panels of DESK.

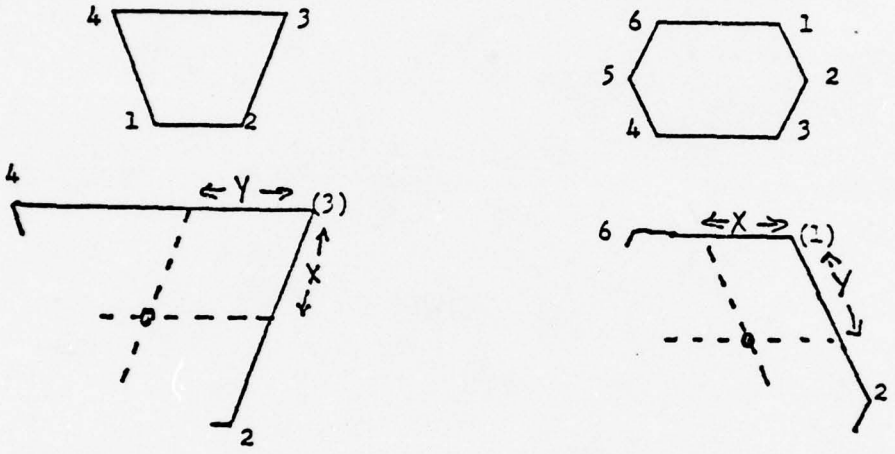


Figure 49. Convention for Determining the Location of a Control in a Panel Relative to the Vertices of that Panel.

4.3.2 Specifying Processing Desired

Program CBMWM allows the user to maintain the data base by the addition, deletion, listing, etc. of the workspace definitions. A function of the program is requested by placing the request on a computer card, one request per card. These requests are in the format shown in Figure 50. These requests on cards plus the workspace definitions to be added are used as input to the program. These control cards may be in any order in the input to the program, with one exception. If the data base is to be initialized the $INT control card must be first. In each of the following paragraphs, the control card format of the particular function is listed first with keywords underlined. This is followed by text which explains each keyword. Additional data formats, if any, are described within the text for each function.

4.3.2.1 Add Workspace Member Function

$ADD membername npnls nctls srpx srpy srpz
x y z (followed by a workspace definition).

The Add Workspace Member function, as defined by the $ADD control card and the workspace definition cards following, add to the Workspace Data Base the specified data under the name membername. The membername is limited to a maximum length of eight characters. The workspace definition contains npnls panels, and nctls controls. Each of these numbers should be entered as an integer, right justified in its three digit field. The Seat Reference Point (SRP) coordinates, in the coordinate system used to define the workspace, are (srpx, srpy, srpz). These are entered as real numbers. If a decimal point is omitted, the program CBMWM will automatically place one between the second and third digits, from the right of the field. The direction of the positive x coordinate is indicated by the character in the x field. The direction of the positive y and z coordinates are shown by the y and z fields, respectively. The possible values for x, y or z are F for forward, A for aft, L for left, R for right, U for up and D for down.

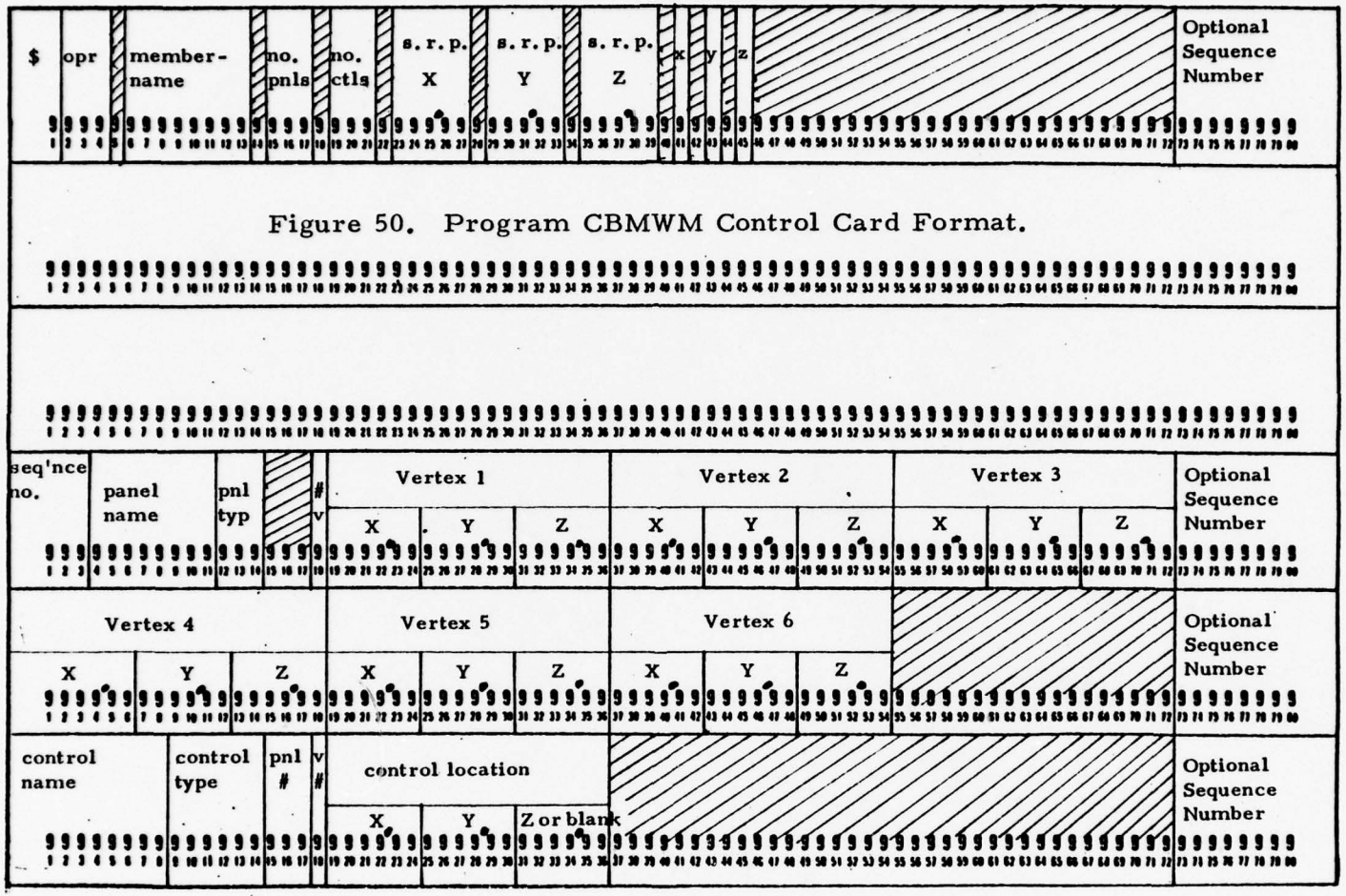


Figure 50. Program CBMWM Control Card Format.

Figure 51. (a) Program CBMWM ADD Member Card Format for Panels.

(b) Program CBMWM ADD Member Card Format for Panels (Continued).

(c) Program CBMWM ADD Member Card Format for Controls.

For each workspace panel being defined there are two data card formats, shown in Figure 51a and 51b. In Figure 51a, columns 1-3 contain a integer sequence number of the panel, right-justified in the field. The first panel entered should have a sequence number of one. Columns 4-11 contain the eight-character name of the panel. Columns 15-17 contain the panel type, as an integer, right justified. This field is not used at present and may be left blank. Column 18 contains the count of the number of vertices of the panel right justified. The panel must have from 3 to 6 vertices. The x, y and z coordinates of each vertex are entered into their appropriate locations on the data card. Vertices are entered consecutively, going either clockwise or counterclockwise around the perimeter of the panel. All the panel definitions are listed together.

Each control is defined on a card using the format in Figure 51c. The control name is listed in columns 1-8. The control type field is not used at this time, and should be left blank. If the control is to be defined relative to a vertex, pnl# references a panel defined previously. The entry is an integer value, right justified in the field. The vertex which the control is relative to is specified in the one digit field v#. If a value is entered for pnl#) the field v# must be non-zero. The coordinates of the control are real numbers. If the location is relative to a defined panel, the z-field is blank. If the location is absolute, all three values (for x, y, and z) must be supplied. If no decimal point is supplied, the program places one between the second and third right-most digits.

An example of the input definition for the member "DESK" is shown in Figure 52. The first outlined area is the $ADD control card. The second outlined area defines the panel definition cards. This is followed by the control definition cards.

Should an error be detected by the program in the input data for a member, the member is not added, but continues to be checked for other errors.

```
$ADD DESK          7   8 -15.0    0.0 -11.0 F L U
  1TOP            04    0.0   30.0    0.0   33.0   30.0    0.0   33.0  -30.0    0.0
   0.0  -30.0    0.0
  2DRWRS-LT       04    0.0   30.0    0.0    0.0   13.0    0.0    0.0   13.0  -21.0
   0.0   30.0  -21.0
  3DRWRS-RT       04    0.0  -30.0    0.0    0.0  -13.0    0.0    0.0  -13.0  -21.0
   0.0  -30.0  -21.0
  4DRWRS-CT       04    0.0   13.0    0.0    0.0   13.0   -5.0    0.0  -13.0   -5.0
   0.0  -13.0    0.0
  5WELL-LT        04    0.0   13.0   -5.0    0.0   13.0  -21.0   33.0   13.0  -21.0
  33.0   13.0   -5.0
  6WELL-RT        04    0.0  -13.0   -5.0    0.0  -13.0  -21.0   33.0  -13.0  -21.0
  33.0  -13.0   -5.0
  7WELL-TOP       04    0.0   13.0   -5.0   33.0   13.0   -5.0   33.0  -13.0   -5.0
   0.0  -13.0   -5.0
L-F-CRNR          0  12   0.0    0.0
L-S-CRNR          0  11   0.0    0.0
R-F-CRNR          0  13   0.0    0.0
R-S-CRNR          0  14   0.0    0.0
DRWRCTNR          0  42   0.0  -13.0
DRWRLB            0  00  -1.0   22.0  -19.0
DRWRLC            0  00  -1.0   22.0  -13.0
DRWRLT            0  00  -1.0   22.0   -7.0
```

(1)

(2)

(3)

Figure 52. Sample Data for $ADD Member Function.

4.3.2.2 Check Workspace Member Function

$CHK membername

The Check Workspace Member function operates in the same fashion as the Add Workspace Member function does, EXCEPT that the member is not added. The member is only checked for errors.

4.3.2.3 Delete Workspace Member Function

$DEL membername

The Delete Workspace Member function removes the specified workspace member from the data base, but does NOT make the space the member occupied available for reuse. In order to make the space available again for use, use the Compress Workspace Data Base function.

4.3.2.4 Compress Workspace Data Base Function

$CMP

The Compress Workspace Data Base function makes available space used to store workspace members which was previously made unavailable by the Delete Workspace Member function. It does this by shoving used space together, thus maximizing the amount of continuous unused space. The intermediate blocks of unused space were created by the Delete Workspace Member function. The greater the activity of the Workspace Data Base (i.e. - $ADD's and $DEL's), the more often it becomes necessary to use this function. Should the message "CBM127A NO SPACE, CANNOT ADD membername" appear, it is necessary to use this function. Should the compress function be followed by the $ADD function which gives the CBM127A message, the data base is full and no additional members can be added until an existing member is deleted.

4.2.3.5 Dump Workspace Member Function

$DMP membername

$DMP

The Dump Workspace Member function prints the contents of the workspace member specified, membername, or the complete

Worksapce Data Base if no member name is given on the control card. The format of the display, per record, is:

RECORD nn +=+ (record in EBCDIC) +=+

+=+ (record in hexadecimal) +=+

+=+ (rest of record in hexadecimal) +=+

The +=+ characters act as delimeters of the displayed data. This function is used primarily by system programmers when testing the file.

4.3.2.6 End Program Function

$END

The End Program function control card terminates execution of the program and returns control to the operating system.

4.3.2.7 Initialize Workspace Data Base Function

$INT

The Initialize Workspace Data Base function will reset the data base to its original unused state. Any members that were on the data base before the function was invoked will be purged. The primary purpose of this function is to establish a data base.

4.3.2.8 Punch Workspace Member Function

$PCH membername

The Punch Workspace Member function will punch a copy of the specified member in a format that the Add Workspace Member function requires. The member is punched onto computer cards. Specifying a member name that does not exist causes a printout of the members names that are on the data base. This function does not remove the member from the data base.

4.3.2.9 Print Workspace Member Function

$PRT membername

$PRT

The Print Workspace Member function will print the contents of the specified member, membername, in a format similar to that

of the Add Workspace Member function. Specifying no name, or a name that is not in the data base causes a print out of the index which contains names of members in the data base, the record numbers the members occupy in the data base, and the origin and orientation that was specified when the member was added.

4.3.3 Submitting a Processing Request

In order to execute the program CBMWM for the purpose of manipulating the Workspace Data Base, a set of Job Control Cards (JCL) must be used. These cards ask the system for the program CBMWM, and allocate the files, such as the data base itself, which are required by the program. The sequence of JCL needed to CBMWM is shown in Figure 53. All function control cards, and member definition cards follow the "//SYSIN DD *" card in the sequence. The //FT01F001 card included in this sequence assumes that the space for the data base already has been allocated on disk. If this condition is not met, the //FT01F001 card specified in Figure 53 should be replaced by the sequence of cards shown in Figure 54. The first function control card in this case should be the $INT card, which will initialize the data base. This sequence to allocate space for the data base and to initialize it should be executed only once. Thereafter, the simplified //FT01F001 card shown in Figure 53 should be used for all file manipulations.

The last function control card read into the program should be the $END control card.

4.3.4 Interpreting the Output Data Received

The program CBMWM generates output to the card punch, to the disk file, or to the printer, depending on the control card function specified. The formats for the printed output will be discussed in this section. Punched records use the same format as the input data records discussed in Paragraph 4.3.2, and will not be described here. The format for the records on the data base should be of no concern to the normal user, and will therefore not be described here. If the user needs to know the format for the records on the data base, he should contact the systems programmer.

```
//CBMWM    JOB   (UDR807,KC),S.M.EVANS,MSGLEVEL=(1,1)      RUN DECK
//JOBLIB   DD    DSNAME=COMBIMAN.LINKLIB,DISP=SHR
//         EXEC  PGM=CBMWM
//FT01F001 DD    DSNAME=COMBIMAN.WKSPDATA,DISP=OLD
//FT05F001 DD    DDNAME=SYSIN
//FT06F001 DD    SYSOUT=A
//FT07F001 DD    SYSOUT=B
//SYSUDUMP DD    SYSOUT=A
//SYSIN    DD    *


        CBMWM FUNCTION CONTROL CARDS AND
         MEMBER DEFINITION DATA GO HERE


/*
//
```

Figure 53. Job Control Cards for Program CBMWM.

```
//FT01F001 DD    DSNAME=COMBIMAN.WKSPDATA,DISP=(,CATLG),VOL=SER=PUBLIC,X
//             UNIT=SYSDA,SPACE=(368,2000),                              X
//             DCB=(BLKSIZE=368,LRECL=368,RECFM=F)
```

Figure 54. FT01 DD Card to Allocate Space on Disk.

Five basic types of output are used by CBMWM when outputting records to the printer. Each of these format types, their use, and an example of each will be presented in this subsection. Each of the types begin with the same heading, listing the source program (CBMWM), the date and time of the program execution, and a page number.

The first type of output is generated by the Initialize, Punch, Compress, Delete and End functions. The nature of these functions does not necessitate a large amount of printed output to be supplied to the user. The output informs the user of the start and end of processing associated with the function specified. For the Compress function, additional messages are supplied, telling the user that a particular member was, or was not, moved in the process of combining unused space. An example of this format, for the Compress function is shown in Figure 55.

The second type of output is generated by the Print or Punch functions when the $PRT or $PCH control cards are supplied with a blank membername field. This causes a listing of the index of the data base. The location and definition data for each member is contained on the index as one record. This information is printed to the user in the following format:

nn.) membername, EXTENT = (n1, n2), np PANELS, nc CONTROLS,
ORIGIN = (xx, yy, zz), ORIENT = (a, b, c)

where:

- nn is the number of this member identification record within the directory.
- membername is the name of the member identified
- n1 is the location within the data base of the first record of data which defines this member
- n2 is the location of the last record of data which defines this member
- np is the number of panels associated with this member
- nc is the number of controls associated with this member
- xx, yy, zz) is the location of the seat reference point with respect to the origin of the system of coordinates of the workspace

```
CBMWM --- WORK/SPACE CATA BASE MAINTENANCE PROGRAM          10/21/76  16.28.53  PAGE   2

CBM100I $CMP
CBM129I HAC1       NOW IN PLACE.
CBM129I A7E        NOW IN PLACE.
CBM129I A7         NOW IN PLACE.
CBM129I FWC1       NOW IN PLACE.
CBM129I A7-01      NOW IN PLACE.
CBM129I A7E-01     NOW IN PLACE.
CBM129I DESK       NOW IN PLACE.
CBM138I COMPRESS FINISHED.
```

Figure 55. Example of Program CBMWM $CMP Function Output.

a is the orientation of the positive x-axis of the workstation

b is the orientation of the positive y-axis of the workstation

c is the orientation of the positive z-axis of the workstation.

This information was originally supplied to the data base on the $ADD control card. An example of the Print function is shown in Figure 56.

The third type of output is generated by the Dump function. This function should be used primarily by systems programmers to aid in locating the cause of I/O (Input/Output) errors on the data base. For the member specified on the $DMP control card, a message giving directory, or index, information is printed, using the second output format described. Each data record associated with the member is printed in the following format:

RECORD nnn +=+ (record in EBCDIC) +=+

+=+ (record in hexadecimal) +=+

+=+ (remainder of record in hexadecimal) +=+

where nnn is the location within the data base of the record. The record in EBCDIC is printed using a 25A4 format. The record in hexadecimal is printed using a 10Z8 format. An example of the Dump function is shown in Figure 57.

The fourth output format is used by the Check and Add functions. After reading the control card and checking it for errors, the information contained on the card is reformatted and written out to the printer. Any error messages pertaining to data contained on the card would be printed before this message is printed.

Following the control card information, each panel definition card is printed, after it is read and checked for errors. The format used for printing the panel definition cards is as follows:

nn.) pnl nm, TYPE=tt, nv VERTICES -- INPUT COORD -- --ABSOLUTE COORD--

(xx_1, yy_1, zz_1) (ax_1, ay_1, az_1)

$(xx_{nv}, yy_{nv}, zz_{nv})$ $(ax_{nv}, ay_{nv}, az_{nv})$

```
CBMWM --- WORK/SPACE DATA BASE MAINTENANCE PROGRAM                    10/22/76   9. 9.45  PAGE   1

CBM1001 $PRT
        15.) A/E-01   , EXTENT=(    592,    688), 51 PANELS,  46 CONTROLS, ORIGIN=(   0.0 ,   0.0 ,   0.0 ), ORIENT.=(F,L,U).
        16.) A/-01    , EXTENT=(    489,    591), 57 PANELS,  46 CONTROLS, ORIGIN=(   0.0 ,  -5.60,  -4.25), ORIENT.=(R,F,U).
        17.) A7       , EXTENT=(    356,    460), 57 PANELS,  46 CONTROLS, ORIGIN=(   0.0 ,   0.0 ,   0.0 ), ORIENT.=(R,F,U).
        18.) FWCI     , EXTENT=(    461,    488), 27 PANELS,   1 CONTROLS, ORIGIN=(   5.00,   0.0 ,   3.00), ORIENT.=(F,L,U),
        19.) A7E      , EXTENT=(     45,    357), 204 PANELS, 109 CONTROLS, ORIGIN=(   0.0 , 103.40, 265.00), ORIENT.=(R,U,A).
        20.) HACI     , EXTENT=(     22,     44), 18 PANELS,   5 CONTROLS, ORIGIN=(  16.00,   0.0 ,  18.00), ORIENT.=(F,L,U).
        21.) DESK     , EXTENT=(    689,    703), 7 PANELS,   8 CONTROLS, ORIGIN=( -15.00,   0.0 , -11.00), ORIENT.=(F,L,U).
```

Figure 56. Example of Program CBMWM $PRT (No Membername) Function Output.

```
CBM1001 $DMP DESK
    21.) DESK      , EXTENT=(      689,      703),    7 PANELS,    8 CONTROLS, ORIGIN=( -15.00,    0.0 , -11.00), ORIENT.=(F,L,U).
  RECORD  689+=+    ATOP               DAO  B   AO  BO  B   AO  BO  B   AO  AO  B   AO                 +=+
  +=+00000001E3D6D7404040404000CCCCC00000000C441FCCCC0421E0000418000004 23C00004 21E00004180000042300000+=+
  +=+C21E0000418000041F00000C21E0000418OCCC0000CC00000CC0C000000000000000000000000000000000000+=+
  RECORD  690+=+    BDRWRS-LT          CAO  B   AO  AO  AE  AO  AO  AE  A-  AO  B   A-                 +=+
  +=+000000002C4D9E6D9E260D3E30000000CCCC0C0C00441F0C000421E0000418000041FC00004 1D000004180000041F00000+=+
  +=+41D00000C1A0000041F0000421E0000C1ACCCCC0C00C0C000CC0C00000000000000C00000000000000000000+=+
  RECORD  691+=+    CDRWRS-RT          CAO  B   AO  AO  AE  AO  AO  AE  A-  AO  B   A-                 +=+
  +=+00000003C4D9E6D9E260D9E30C00CCC00000000441FC000C0C21E0000418000041F00000C1D000004180000041F00000+=+
  +=+C1D00000C1A0000041F00000C21E0000C1A000CCOCCCCOC000CC0C0C000000000C000000000000000000000000+=+
  RECORD  692+=+    DDRWRS-CT          CAO  AE  AO  AO  AE  A-  AO  AE  A-  AO  AE  AO                 +=+
  +=+00000004C4D9E6D9E260C3E300000CCCCCC0C00441FC000041DC00004180000041F00000 41D00000416000041F00000+=+
  +=+C1D00000416000041F00000C1D0000041BOCCC00CC0C00000000C000000000000000000000000000000000000+=+
  RECORD  693+=+    EWELL-LT           CAO  AE  A-  AO  AE  A-  BO  AE  A-  BO  AE  A-                 +=+
  +=+00000005E6C5D3D360D3E340000C0C0C0C0C00441FC000C41DC0000416000041F00000 41D0000C1A0000042300000+=+
  +=+41D00000C1A00000423000041D000C04160C0C00000C0C0000C0C0000000000000000000000000000000000+=+
  RECORD  694+=+    FWELL-RT           CAO  AE  A-  AO  AE  A-  BO  AE  A-  BO  AE  A-                 +=+
  +=+00000006E6C5D3D360D9E340000C0CCCCCC0C0C441FC000C1DC00004160000041F000001D00000C1A0000042300000+=+
  +=+C1D00000C1A0000042300000C1D0000041600CCCC00C0C000000C0C00000000000000000C000000000000000000+=+
  RECORD  695+=+    GWELL-TOP          CAO  AE  A-  BO  AE  A-  BO  AE  A-  AO  AE  A-                 +=+
  +=+00000007E6C5D3D360E3D6D7000CCC0000C000441FC000C041DC00004160000042300000 41D0000041600000042300000+=+
  +=+C1D00000416000041F00000C1DC000041600GC000CCC00000000C000000000GC00000000000000000000000000+=+
  RECORD  696+=+L-F-CRNR         A   BBO  B   AO                                                         +=+
  +=+D360C660C3D9D5D900000000000000CC10CCC000242300C000421E0C0041800000000C00000000000000000000000000000+=+
  +=+00000000000000000000000000000000000000000CC0CC0000000C000000000000000000000000000000000+=+
  RECORD  697+=+L-S-CRNR         A   AAO  B   AO                                                         +=+
  +=+D360E260C3D9D5D90000000000C000001CCC0000141F00000421E000041B00000000000000000000000000000000000+=+
  +=+0000000000000000000C000000000000C000000000000CCC000000C000C00000000000000000000000000000000+=+
  RECORD  698+=+R-F-CRNR         A   CBO  B   AO                                                         +=+
  +=+D960C660C3D9D5D900000000000000CCC1CCCC000342300000C21E0C00418000000000000000000000000000000000000+=+
  +=+00000000000000000000000000000C0000C000C0C0C0000000000C00C000000000000000000000000000000000+=+
  RECORD  699+=+R-S-CRNR         A   CAO  B   AO                                                         +=+
  +=+D960E260C3D9D5D90000000000C0000C010C000000441F000C00C21E0C0041B0000C0000000000000000000000000000000+=+
  +=+000000000000000000000C000000000000000000C0C00C000C000000000000000000000000000000000000000+=+
  RECORD  700+=+DRWRCTNR         C   EAO          A-        AE                                            +=+
  +=+C4D9E6D9C3E3D5D90000000000000000004000000241FC0C0C00CC00004160000000000000C1D0000000000000000000000G+=+
  +=+00000000000000000000000000000000000CC0CCC00C000C0000000000C00000000000000000000000000000000+=+
  RECORD  701+=+DRWRLB                A-  BO  A                                                         +=+
  +=+C4D9E6D9D3C240400000000000C0CC0CCCCC00000041E0000042160C00C1800000000C0000000000000000000000000000+=+
  +=+0000000000000000C0000000000000C000000000CC000CC0C00000000000000000000000000000000000000000+=+
  RECORD  702+=+DRWRLC                A-  BO  A-                                                        +=+
  +=+C4D9E6D9D3C3404000000000000000C0CCC0CCCC0000041E0000042160000C1200000000000000000C000000000000000000+=+
  +=+000000000000000000000000000000C0CCC000CCC0000CCC0000000000000000000000000000000000000000000+=+
  RECORD  703+=+DRWRLT                A-  BO  A                                                         +=+
  +=+C4D9E6D9D3E3404000000000000C000C00C00000C041ECCC004216000041400000C00000000000000000000000000000000+=+
  +=+0000000000000000000000000000000000000C00000C0C0C00C0C0000000000000000000000000000000000000+=+
```

Figure 57. Example of Program CBMWM $DMP Function Output Format.

where:

nn	is the panel number
pnl nm	is the panel name
tt	is the panel type
nv	is the number of vertices used to define the panel
xx_i, yy_i, zz_i	are the x, y, and z coordinates for the i^{th} vertex of the panel, in the workstation system of coordinates, where i = 1, nv.
ax_i, ay_i, az_i	are the x, y, and z coordinates of the i^{th} vertex of the panel, converted to the COMBIMAN system of coordinates, where i = 1, nv.

After the panel definition data, the control data is printed, using the following format:

cntl nm tt pnl ref. v.# (xx, yy, zz) TO (ax, ay, az) & (rx, ry)

where:

cntl nm	is the 8 character name of the control
tt	is the 2 digit control type
pnl ref	is the panel the control is located within (if applicable)
v#	is the vertex number within the referenced panel, near which the control is located
xx, yy, zz	are the three dimensional coordinates (relative or absolute) which were read off cards and define the location of the control
ax, ay, az	are the three dimensional absolute coordinates which define the location of the control in the COMBIMAN system of coordinates
rx, ry	are the two dimensional relative coordinates of the control; if the control was not defined relative to a panel, rx=ry=0.0.

An example of this fourth format, for the $ADD control card, is shown in Figure 58.

The fifth and last formati is similar to that used for the Add function, and is used for the Print function when a valid membername is specified. The main difference between this format and the fourth is this format does not print the original input data which was provided when the

```
CBM1001 $PRT DESK
          21.) DESK     , EXTENT=(     689,     703),   7 PANELS,   8 CONTROLS, ORIGIN=( -15.00,   0.0 , -11.00), ORIENT.=(F,L,U).
           1.) TOP      , TYPE= 0, 4 VERTICES --ABSOLUTE COORDINATES-
                                              (  15.00  30.00  11.00)
                                              (  48.00  30.00  11.00)
                                              (  48.00 -30.00  11.00)
                                              (  15.00 -30.00  11.00)
           2.) DRWRS-LT, TYPE= 0, 4 VERTICES --ABSOLUTE COORDINATES-
                                              (  15.00  30.00  11.00)
                                              (  15.00  13.00  11.00)
                                              (  15.00  13.00 -10.00)
                                              (  15.00  30.00 -10.00)
           3.) DRWRS-RT, TYPE= 0, 4 VERTICES --ABSOLUTE COORDINATES-
                                              (  15.00 -30.00  11.00)
                                              (  15.00 -13.00  11.00)
                                              (  15.00 -13.00 -10.00)
                                              (  15.00 -30.00 -10.00)
           4.) DRWRS-CT, TYPE= 0, 4 VERTICES --ABSOLUTE COORDINATES-
                                              (  15.00  13.00  11.00)
                                              (  15.00  13.00   0.00)
                                              (  15.00 -13.00   0.00)
                                              (  15.00 -13.00  11.00)
           5.) WELL-LT , TYPE= 0, 4 VERTICES --ABSOLUTE COORDINATES-
                                              (  15.00  13.00   0.00)
                                              (  15.00  13.00 -10.00)
                                              (  48.00  13.00 -10.00)
                                              (  48.00  13.00   0.00)
           6.) WELL-RT , TYPE= 0, 4 VERTICES --ABSOLUTE COORDINATES-
                                              (  15.00 -13.00   0.00)
                                              (  15.00 -13.00 -10.00)
                                              (  48.00 -13.00 -10.00)
                                              (  48.00 -13.00   0.00)
           7.) WELL-TOP, TYPE= 0, 4 VERTICES --ABSOLUTE COORDINATES-
                                              (  15.00  13.00   0.00)
                                              (  48.00  13.00   0.00)
                                              (  48.00 -13.00   0.00)
                                              (  15.00 -13.00   0.00)
CONTROL- TYPE IN-PANEL POINT --ABSOLUTE COORDINATES-  RELATIVE-COORDINATE
-------- ---- -------- ----- ----------------------  ----------------------
L-F-CRNR    0 TOP          2 (  48.00  30.00  11.00)  (   0.0    0.0 )
L-S-CRNR    0 TOP          1 (  15.00  30.00  11.00)  (   0.0    0.0 )
R-F-CRNR    0 TOP          3 (  48.00 -30.00  11.00)  (   0.0    0.0 )
R-S-CRNR    0 TOP          4 (  15.00 -30.00  11.00)  (   0.0    0.0 )
DRWRCTNR    0 DRWRS-CT     2 (  15.00   0.0    0.00)  (   0.0  -13.00)
DRWRLB      0              0 (  14.00  22.00  -8.00)  (   0.0    0.0 )
DRWRLC      0              0 (  14.00  22.00  -2.00)  (   0.0    0.0 )
DRWRLT      0              0 (  14.00  22.00   4.00)  (   0.0    0.0 )
```

Figure 58. Example of Program CBMWM $ADD Function Output Format.

member was added to the daba base. After the information obtained on the index record for the member has been printed, the panel definition data is output using the following format:

nn.) pnl nm, TYPE=tt, nv VERTICES--ABSOLUTE COORDINATES--

$$(xx_1, yy_1, zz_1)$$
$$\vdots$$
$$(xx_{nv}, yy_{nv}, zz_{nv})$$

where:	nn	is the panel number
	pnl nm	is the 8-character name of the panel
	tt	is the panel type
	nv	is the number of vertices which define the panel
	xx_i, yy_i, zz_i	are the x, y, and z coordinates of the i^{th} vertex of the panel, in the COMBIMAN system of coordinates, where i = 1, nv.

After the panel definition data, the control data is printed, using the following format:

cntl nm tt pnl ref v# (ax, ay, az) (rx, ry)

where:	cntl nm	is the 8-character name of the control
	tt	is the 2 digit control type
	pnl ref	is the panel the control is located within (if applicable)
	v#	is the vertex number within the referenced panel, near which the control is located
	ax, ay, az	are the three dimensional coordinates which define the control in the COMBIMAN system of coordinates
	rx, ry	are the two dimensional relative coordinates of the control; if the control was not defined relative to a panel, rx=ry=0.0.

An example of this fifth format is shown in Figure 59.

```
CBMWM --- WORK/SPACE DATA BASE MAINTENANCE PROGRAM                    10/21/76  16.28.53  PAGE   1

CBM100I $ADD DESK       7   8-15.00  0.0 -11.00 F L U
CBM119I MEMBER, DESK     , HAS    7 PANELS AND    8 CONTROLS.
CBM120I COORDINATES ARE TRANSLATED TO ( -15.00,    0.0 , -11.00).
CBM121I COORDINATES GIVEN AS F, L AND U ARE NOW F, L, AND U.
          1.) TOP      , TYPE= 0, 4 VERTICES --INPUT COORDINATES---     --ABSOLUTE COORDINATES-
                                               (   0.0   30.00   0.0 ) TO (   15.00   30.00   11.00)
                                               (  33.00  30.00   0.0 ) TO (   48.00   30.00   11.00)
                                               (  33.00 -30.00   0.0 ) TO (   48.00  -30.00   11.00)
                                               (   0.0  -30.00   0.0 ) TO (   15.00  -30.00   11.00)
          2.) DRWRS-LT, TYPE= 0, 4 VERTICES --INPUT COORDINATES---     --ABSOLUTE COORDINATES-
                                               (   0.0   30.00   0.0 ) TO (   15.00   30.00   11.00)
                                               (   0.0   13.00   0.0 ) TO (   15.00   13.00   11.00)
                                               (   0.0   13.00 -21.00) TO (   15.00   13.00  -10.00)
                                               (   0.0   30.00 -21.00) TO (   15.00   30.00  -10.00)
          3.) DRWRS-RT, TYPE= 0, 4 VERTICES --INPUT COORDINATES---     --ABSOLUTE COORDINATES-
                                               (   0.0  -30.00   0.0 ) TO (   15.00  -30.00   11.00)
                                               (   0.0  -13.00   0.0 ) TO (   15.00  -13.00   11.00)
                                               (   0.0  -13.00 -21.00) TO (   15.00  -13.00  -10.00)
                                               (   0.0  -30.00 -21.00) TO (   15.00  -30.00  -10.00)
          4.) DRWRS-CT, TYPE= 0, 4 VERTICES --INPUT COORDINATES---     --ABSOLUTE COORDINATES-
                                               (   0.0   13.00   0.0 ) TO (   15.00   13.00   11.00)
                                               (   0.0   13.00  -5.00) TO (   15.00   13.00    6.00)
                                               (   0.0  -13.00  -5.00) TO (   15.00  -13.00    6.00)
                                               (   0.0  -13.00   0.0 ) TO (   15.00  -13.00   11.00)
          5.) WELL-LT , TYPE= 0, 4 VERTICES --INPUT COORDINATES---     --ABSOLUTE COORDINATES-
                                               (   0.0   13.00  -5.00) TO (   15.00   13.00    6.00)
                                               (   0.0   13.00 -21.00) TO (   15.00   13.00  -10.00)
                                               (  33.00  13.00 -21.00) TO (   48.00   13.00  -10.00)
                                               (  33.00  13.00  -5.00) TO (   48.00   13.00    6.00)
          6.) WELL-RT , TYPE= 0, 4 VERTICES --INPUT COORDINATES---     --ABSOLUTE COORDINATES-
                                               (   0.0  -13.00  -5.00) TO (   15.00  -13.00    6.00)
                                               (   0.0  -13.00 -21.00) TO (   15.00  -13.00  -10.00)
                                               (  33.00 -13.00 -21.00) TO (   48.00  -13.00  -10.00)
                                               (  33.00 -13.00  -5.00) TO (   48.00  -13.00    6.00)
          7.) WELL-TOP, TYPE= 0, 4 VERTICES --INPUT COORDINATES---     --ABSOLUTE COORDINATES-
                                               (   0.0   13.00  -5.00) TO (   15.00   13.00    6.00)
                                               (  33.00  13.00  -5.00) TO (   48.00   13.00    6.00)
                                               (  33.00 -13.00  -5.00) TO (   48.00  -13.00    6.00)
                                               (   0.0  -13.00  -5.00) TO (   15.00  -13.00    6.00)
     CONTROL- TYPE IN PANEL POINT ---INPUT COORDINATES---     --ABSOLUTE COORDINATES-  RELATIVE-COORDINATES
     -------- ---- -------- ----- ----------------------     ----------------------  --------------------
     L-F-CRNR    0 TOP          2 (   0.0     0.0     0.0 ) TO (  48.00   30.00   11.00) & (   0.0     0.0 )
     L-S-CRNR    0 TOP          1 (   0.0     0.0     0.0 ) TO (  15.00   30.00   11.00) & (   0.0     0.0 )
     R-F-CRNR    0 TOP          3 (   0.0     0.0     0.0 ) TO (  48.00  -30.00   11.00) & (   0.0     0.0 )
     R-S-CRNR    0 TOP          4 (   0.0     0.0     0.0 ) TO (  15.00  -30.00   11.00) & (   0.0     0.0 )
     DRWRCTNR    0 DRWRS-CT     2 (   0.0   -13.00     0.0 ) TO (  15.00    0.0     6.00) & (   0.0   -13.00)
     DRWRLB      0              0 (  -1.00   22.00   -15.00) TO (  14.00   22.00   -8.00) & (   0.0     0.0 )
     DRWRLC      0              0 (  -1.00   22.00   -13.00) TO (  14.00   22.00   -2.00) & (   0.0     0.0 )
     DRWRLT      0              0 (  -1.00   22.00    -7.00) TO (  14.00   22.00    4.00) & (   0.0     0.0 )
CBM134I DESK      WITH    7 PANELS AND    8 CONTROLS HAS BEEN ADDED.
```

Figure 59. Example of Program CBMWM $PRT (Membername) Function Output Format.

4.4 PROGRAM MESSAGES - INCLUDING ERROR CORRECTION

The program CBMWM prints out both instruction and action messages. The message format for both is as follows:

CBM1nni message text

where

nn is the message number,

i indicates the action code (I = informational, A =action to be performed), and

message text is the text of the message.

Unless otherwise noted, all messages are generated by the routine CBMWDM.

The messages in effect to date are as follows:

CBM100I control card image

Reason: User has submitted a control card.
System Action: None.
User Action: None.

CBM101A operation UNKNOWN OPERATION.
Reason: The operation on the control card (shown in the previous CBM100I message) is unknown.
System Action: This control card is ignored.
User Action: Correct the card and resubmit.

CBM102A panelnumber INVALID PANEL NUMBER FOR POINT controlname.
Reason: The panel number which the control definition card specifies does not exist.
System Action: The control is considered to be defined with absolute coordinates.
User Action: Check to see that the number was right-justified in the field. Delete the Workspace member, correct the card, and resubmit.

CBM103A vertexnumber INVALID VERTEX NUMBER FOR POINT controlname.
Reason: The panel in which the control is to exist does not have vertex vertexnumber.
System Action: Vertex number 1 is used.
User Action: Delete the Workspace member, correct the error and resubmit the job.

4.4 PROGRAM MESSAGES - INCLUDING ERROR CORRECTION

The program CBMWM prints out both instruction and action messages. The message format for both is as follows:

CBM1nni *message text*

where

nn is the message number,

i indicates the action code (I = informational, A =action to be performed), and

message text is the text of the message.

Unless otherwise noted, all messages are generated by the routine CBMWDM.

The messages in effect to date are as follows:

CBM100I *control card image*

Reason: User has submitted a control card.
System Action: None.
User Action: None.

CBM101A *operation* UNKNOWN OPERATION.
Reason: The operation on the control card (shown in the previous CBM100I message) is unknown.
System Action: This control card is ignored.
User Action: Correct the card and resubmit.

CBM102A *panelnumber* INVALID PANEL NUMBER FOR POINT *controlname*.
Reason: The panel number which the control definition card specifies does not exist.
System Action: The control is considered to be defined with absolute coordinates.
User Action: Check to see that the number was right-justified in the field. Delete the Workspace member, correct the card, and resubmit.

CBM103A *vertexnumber* INVALID VERTEX NUMBER FOR POINT *controlname*.
Reason: The panel in which the control is to exist does not have vertex *vertexnumber*.
System Action: Vertex number 1 is used.
User Action: Delete the Workspace member, correct the error and resubmit the job.

CBM104A Z NOT ZERO, PANEL & VERTEX NOW ZERO FOR POINT controlname.

Reason: A panel number and a vertex number were specified, but the Z value was not zero. Z is now zero.

System Action: Z is made zero and processing continues.

User Action: If setting z equal to zero corrects the problem, no action needed. Otherwise, delete the workspace member, correct the card and resubmit.

CBM105A NO NAME GIVEN, operation IGNORED.

Reason: This operation requires a Workspace member name, but none was supplied.

System Action: The operation is ignored.

User Action: Supply the member name and re-submit.

CBM106A membername NOT FOUND.

Reason: For the Delete function ($DEL), Dump function ($DMP), Punch function ($PCH) or Print function ($PRT) the Workspace member name given does not exist.

System Action: The directory of the Workspace data base is printed for the user, instead of the requested function.

User Action: Check the control card for misspelling of the member name.

CBM107A NUMBER OF PANELS/CONTROLS INVALID FOR MEMBER membername.

Reason: The number of panels or controls as specified on the Add function control card ($ADD) is either less than 1 or greater than 300.

System Action: The control card is ignored.

User Action: If the number as specified is less than 1, correct and re-submit. If the number as specified is greater than 300, split the workspace definition in two units and add separately.

CBM108A axis FOR X INVALID, MEMBER IS membername.

Reason: During the Add function ($ADD), the direction of the user's X-axis is not F (forward), A (aft), L (left), R (right), U (up) or D (down).

System Action: The control card is ignored.

User Action: Correct the control card and re-submit.

CBM109A axis FOR Y INVALID, MEMBER IS membername.

Reason: During the Add function ($ADD), the direction of the user's Y-axis is not F, A, L, R, U or D.

System Action: The control card is ignored.

User Action: Correct the control card, and re-submit.

CBM110A axis FOR Z INVALID, MEMBER IS membername.
Reason: During the Add function ($ADD), the direction of the user's Z-axis is not F, A, L, R, U or D.
System Action: The control card is ignored.
User Action: Correct the control card and re-submit.

CBM111A X&Y, X&Z OR Y&Z ARE COLINEAR FOR MEMBER membername.
Reason: The direction of either the X&Y, or the X&Z or the Y&Z user's axis are the same (ex. X=L & Y=U & Z=U).
System Action: The control card is ignored.
User Action: Pick unique directions for the axes and re-submit.

CBM112A DIRECTORY IS FULL, CANNOT ADD membername.
Reason: No space is left in the Workspace Data Base directory to add an entry for this member.
System Action: The control card is ignored.
User Action: Remove a member from the data base, and re-submit, or enlarge the directory.

CBM113A PANEL IS ZERO, BUT POINT IS NOT FOR membername.
Reason: In defining a control, either both the panel number and the point number must be zero (or blank), or non-zero.
System Action: The control definition is taken as absolute.
User Action: Correct and re-submit.

CBM114A membername ALREADY EXISTS.
Reason: User has tried to add a workspace definition under a name that already exists in the data base.
System Action: The control card is ignored.
User Action: Use a new name, and re-submit.

CBM115A END OF DATA.
Reason: The end of the control cards was found before the END Program control card ($END).
System Action: The program is ended.
User Action: Check to make sure that all the control cards were processed.

CBM116A I/O ERROR ON RECORD recordnumber (INDEX).
Reason: An I/O error occurred on the Workspace Data Base.
System Action: Terminate the program.
User Action: Contact Systems Programmer.

CBM117A I/O ERROR ON RECORD recordnumber (DATA).
Reason: An I/O error has occurred on the Workspace Data Base.
System Action: Terminate the program.
User Action: Contact systems programmer.

CBM119I NEW MEMBER, membername, HAS nn PANELS AND nn CONTROLS.
Reason: The user has added a Workspace definition to the data base.
System Action: The addition is accepted.
User Action: None.

CBM120I COORDINATES ARE TRANSLATED TO seat reference point coordinate.
Reason: The user has added a Workspace definition to the data base.
System Action: The addition is accepted.
User Action: None.

CBM121I COORDINATES GIVEN AS axis, axis AND axis ARE NOW R, F, AND U.
Reason: The user has added a Workspace definition to the data base.
System Action: The addition is accepted.
User Action: None.

CBM122I PROGRAM END.
Reason: Either the End Program function control card ($END) card was encountered, the end of the deck on control cards was encountered, or there was an I/O error.
System Action: The program ends.
User Action: Check to make sure that all control cards were accepted, and processed correctly.

CBM123I membername DELETED.
Reason: The user submitted a DELETE Workspace Definition function control card ($DEL).
System Action: The requested deletion was made.
User Action: None.

CBM123I INITIALIZED.
Reason: The user requested that the Workspace data base be initialized via the Initialize Workspace Data Base Function ($INT).
System Action: The data base is initialized.
User Action: None.

CBM125A PANEL NOT DEFINED FOR CONTROL controlname.
Reason: In defining a control, the user specified that the control was in a panel that has not been defined in this Workspace definition.
System Action: The control is defined absolutely.
User Action: Check to make sure the panel has been defined. Correct and re-submit.

CBM126I membername PUNCHED.
Reason: The user requested that member membername be punched on cards.
System Action: Punching is completed.
User Action: None.

CBM127A NO SPACE, CANNOT ADD membername.
Reason: There is not enough space in the data base to hold the requested addition.
System Action: The control card is ignored.
User Action: Delete or punch an inactive definition to provide enough space to add the desired definition, or enlarge the data area of the data base.

CBM128I membername WAS IN PLACE.
Reason: The user requested the data base be compressed. The member, membername was already compressed, and not moved.
System Action: The name member was not moved. Compression continues.
User Action: None.

CBM129I membername NOW IN PLACE.
Reason: The user requested the data base be compressed, the member, membername was not in place, and therefore has been compressed.
System Action: The member is compressed. Compression is continued.
User Action: None.

CBM130A panelname USED IN PANELS $panelnumber_1$ AND $panelnumber_2$.
Reason: In defining a Workspace member, two panels have the same name. The number of these panels are $panelnumber_1$ and $panelnumber_2$.
System Action: Both panels are accepted in spite of the duplicate names.
User Action: Delete the definition, change one of the names, and re-add.

CBM131A panelname HAS SAME PANEL NUMBER AS panelnumber.
Reason: In adding a Workspace definition, two panels have the same panel number.
System Action: Both panels are accepted. Note that references to the second will be references in reality to the first.
User Action: Delete the Workspace definition, correct the error, and re-add.

CBM132A controlname IS A DUPLICATE NAME.
Reason: In adding a Workspace definition, two controls have the same name.
System Action: Both controls are added with the same name. References to either one result in references to only the first.
User Action: Delete the definition, change one of the names to make it unique, and re-submit.

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